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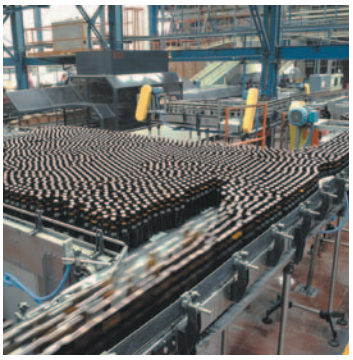

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Pneumatic Actuator Products

Cylinders, Guided Cylinders and Rotary Actuators

Catalog 0900P-E

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Application Engineering Data		A Engineering Data
Tie Rod Cylinders	***3MA/4MA Series, 3MAJ/4MAJ Series, 4MNR Series, ACVB Option, LPSO Option, S Series, C Series***	B Tie Rod Cylinders
ISO Cylinders	***P1D Series, P1A Series***	C ISO Cylinders
Round Body Cylinders	***SR Series, SRM Series, SRD/SRDM Series, SRX Series, P1L Series, P Series***	D Round Body Cylinders
Compact Cylinders	***P1M Series, P1M Series with Tooling Plate, P1M Series Swing Clamp, LP/LPM Series, C05 Series, P1G Series***	E Compact Cylinders
Guided Cylinders	***P5T Series, P5T2 Series, P5L Series, HB Series, P5E Series***	F Guided Cylinders
Rodless Cylinders	***OSP-P, P1X Series, P1Z Series, RC Series, GDL***	G Rodless Cylinders
Rotary Actuators	***PV Series, PRN(A) Series, WR Series, PTR Series, B671/F672 Series, HP Series, P5W Series***	H Rotary Actuators
Pneumatic Grippers	***For Complete Information, Refer to Catalog 1900-2***	J Pneumatic Grippers
Air Motors	***P1V-S Series*** ***For Complete Information, Refer to Catalog PDE2554TCUK-ul***	K Air Motors
Complementary Products	***Linear Alignment Couplers, Flow Controls, 4TK Air Oil Tanks, PRL Series, Transition Kits***	L Complementary Products
Electronic Sensors	***Solid State, Reed and Proximity Sensors***	M Electronic Sensors
Industrial Shock Absorbers	***Industrial Shock Absorbers (Linear Decelerators)***	N Industrial Shock Absorbers
Fax Forms, Safety Guide, Offer of Sale	***Application FAX Forms***	P Fax Forms, Safety Guide, Offer of Sale

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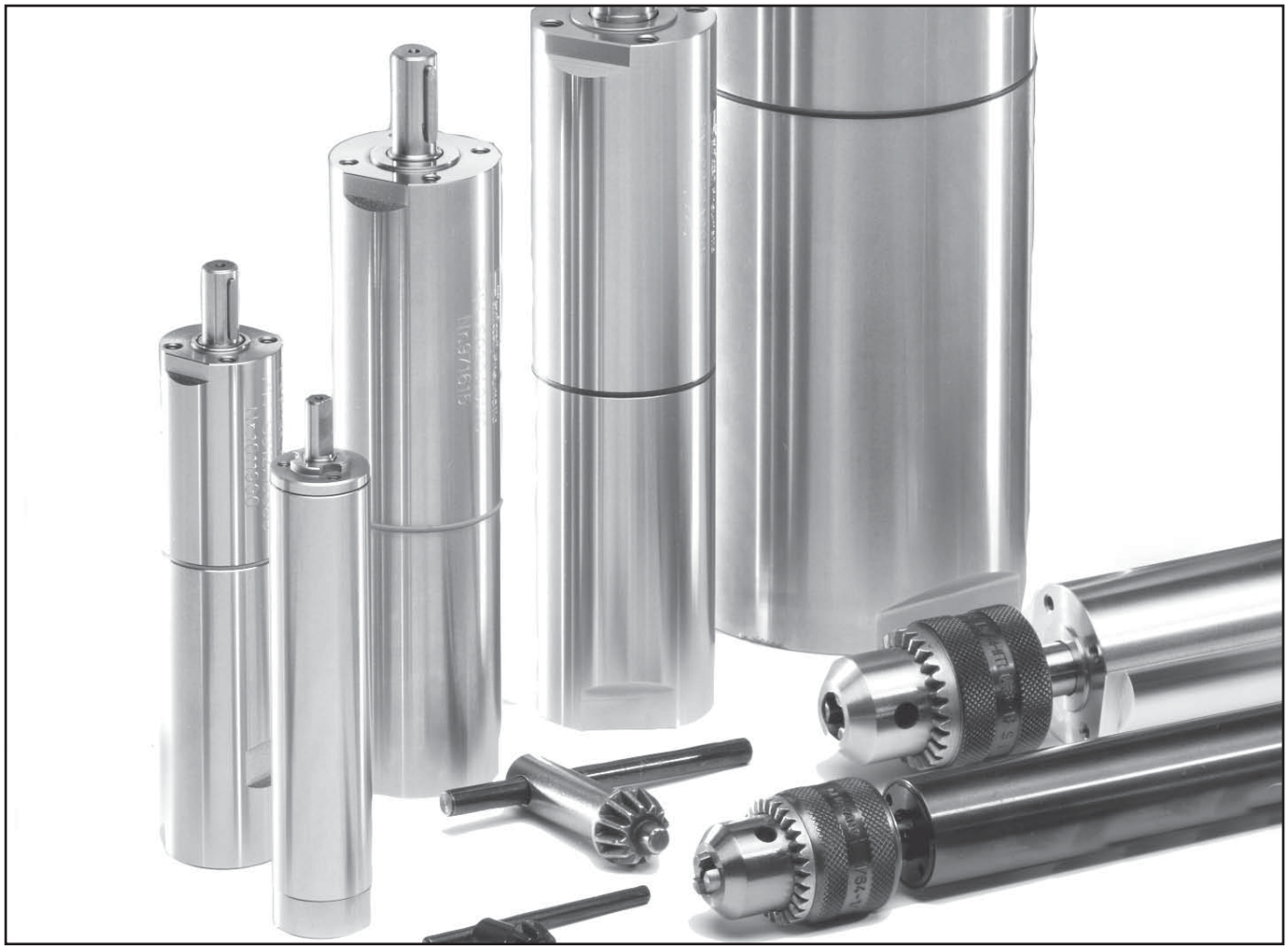
Air Motors

P1V-S

Section K



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Features	Air Motor	Hydraulic Motor	Electric Motor	Electric Motor Regulated	Electric Motor Regulated with Feedback
Overload safe	***	***	*	**	***
Increased torque at higher loads	***	**	*	**	***
Easy to limit torque	***	***	*	*	***
Easy to vary speed	***	***	*	***	***
Easy to limit power	***	***	*	**	***
Reliability	***	***	***	***	***
Robustness	***	***	*	*	*
Installation cost	***	*	**	**	**
Ease of service	***	**	*	*	*
Safety in damp environments	***	***	*	*	*
Safety in explosive atmospheres	***	***	*	*	*
Safety risk with electrical installations	***	***	*	*	*
Risk of oil leak	***	*	***	***	***
Hydraulic system required	***	*	***	***	***
Weight	**	***	*	**	*
Power density	**	***	*	*	*
High torque for size	**	***	*	*	*
Noise level during operation	*	***	**	**	**
Total energy consumption	*	**	***	***	***
Service interval	*	**	***	***	***
Compressor capacity required	*	***	***	***	***
Purchase price	*	*	***	***	**
Accuracy, speed	*	**	*	**	***
Regulating dynamic	*	*	*	*	***
Communication	*	*	*	***	***

K

* = good

** = average

*** = excellent

Important!
Before carrying out service activities, make sure the air motor is vented. Before disassembling the motor, disconnect the primary air hose to ensure that the air supply is interrupted.

NOTE!
All technical data in the catalog are typical values.

The air quality is a major factor in the service life of the motor, see ISO 8573-1.

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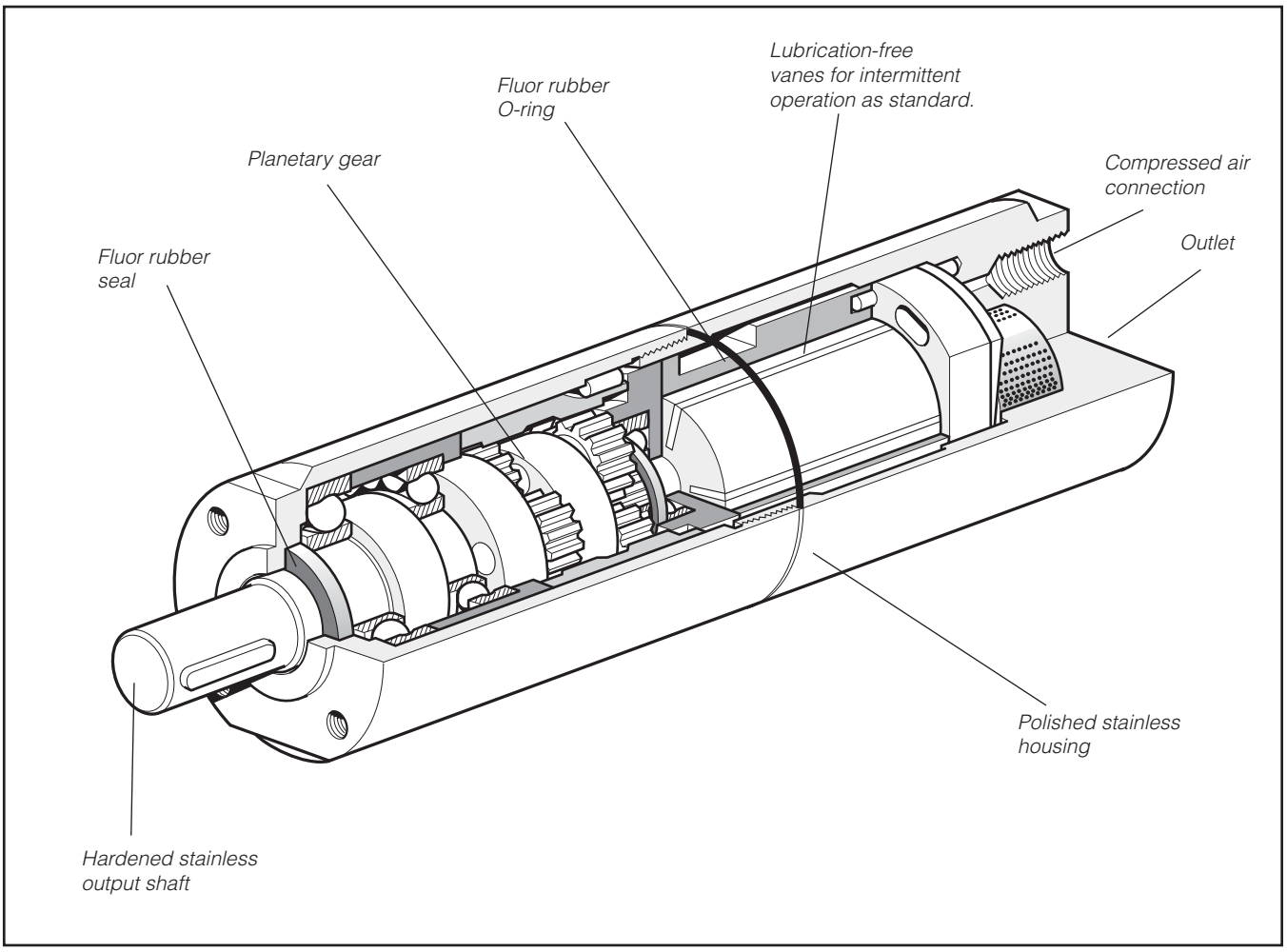

Stainless Steel Air Motors, P1V-S Series

P1V-S is a range of air motors with all external components made of stainless steel, which means that they can be used in food grade applications, and in all other applications where there is a risk of corrosion.

The range contains seven different sizes, with powers ranging from 20 to 1 200 Watts, and speeds from 5 to 24 000 rpm. The air motor and planetary reduction gear are built into a polished stainless steel housing, which is sealed by a fluor rubber O-ring. The output shaft, which is made of polished stainless steel, is also sealed by a fluor rubber seal .

Consideration for achieving a clean, hygienic design was given early on in the development of this range of air motors. Thanks to the cylindrical shape, there are no pockets which can accumulate dirt or bacteria. Additionally, the two halves of the motor body are sealed with an o-ring to prevent contamination. The choice of materials reflects the fact that aggressive cleaning materials are used in food grade applications.

The P1V-S series is designed to be operated in intermittent intervals under non-lubrication conditions. For this reason, no particles of lubricant escape with the exhaust air and the service costs are reduced. This means that the motors can be used directly in food grade applications. The planetary gear, which has one or more reduction stages, is lubricated with an USDA-H1 standard grease, approved for use in food grade applications.

Products particularly suitable for the food industry.

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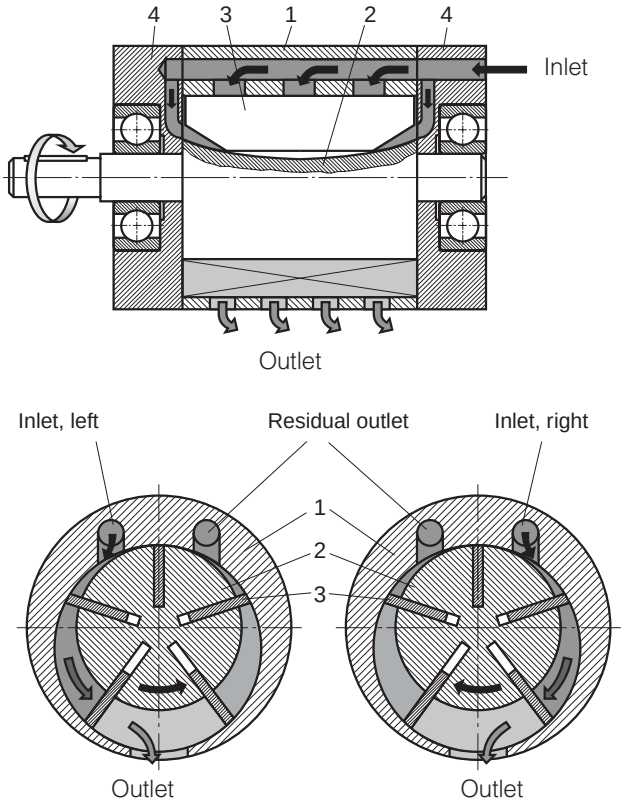
Principles of Motor Operation

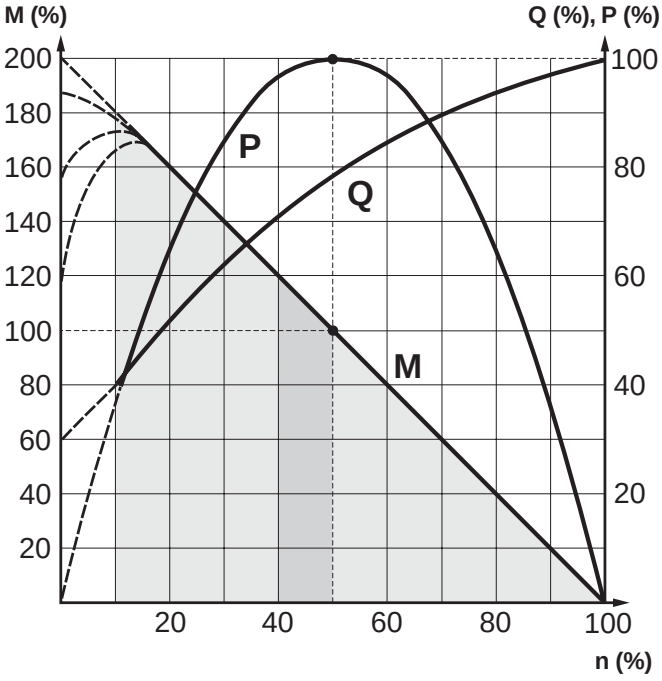


1 Rotor cylinder
2 Rotor
3 Vanes
4 End piece with bearing

There are a number of designs of air motors. Parker Hannifin has chosen to use the vane rotor design, because of its simple design and reliable operation. The small external dimensions of vane motors make them suitable for all applications. The complete unit consists of a motor built together with a planetary reduction gear to give the required speed and torque at the output shaft.

The design of a vane air motor consists of a rotor which incorporates a given number of vanes all enclosed within a cylinder. The cylinder will include three ports; an inlet pressure port, an exhaust port and a residual port. Reliable starting is ensured by the fact that the inlet air presses the vanes against the cylinder wall prior to rotation. During operation, the vanes are pressed outwards by centrifugal force. The air pressure always acts at right angles to the vane surface, which means that the available torque is determined by the surface area of the vanes and by the air pressure. As each vane reached it's lowest point air is released through the exhaust port. As the rotation continues air may be trapped and compressed between vanes. This compressed air is released through the residual port. The residual port doubles as the pressure port when the motor is operated in the reverse direction.

Torque, Power and Air Consumption Graphs



The curve is for 6 bar
P = power **Q = air consumption**
M = torque **n = speed**

Possible working range of motor.

Optimum working range of motor.
Higher speeds = more vane wear

Lower speeds with high torque = more gearbox wear

The performance characteristics of each motor are shown in a family of curves as above, from which torque, power and air consumption can be read off as a function of speed. Power is zero when the motor is stationary and also when running at free speed (100%) with no load. Maximum power (100%) is normally developed when the motor is braked to approximately half the free speed (50%).

Torque at free speed is zero, but increases as soon as a load is applied, rising linearly until the motor stalls. As the motor can stop with the vanes in various positions, it is not possible to specify an exact starting torque. However, a minimum starting torque is shown in all tables.

Air consumption is greatest at free speed, and decreases with decreasing speed, as shown in the above diagram.

Please refer to the curve on page K63 for these pressures:
3, 4, 5, 6 and 7 bar

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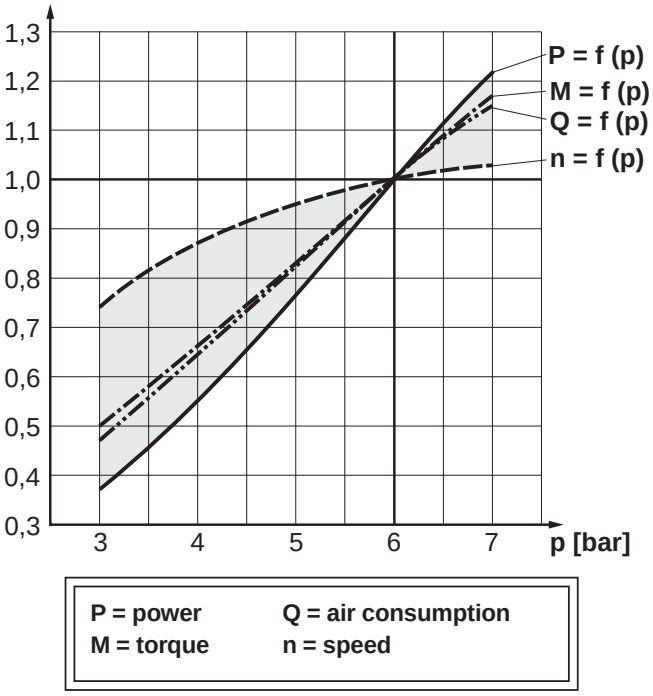
Correction Diagram

Correction Factor



All catalog data and curves are specified at a supply pressure of 6 bar (in the inlet port). This diagram shows the effect of pressure on speed, torque, power and air consumption.

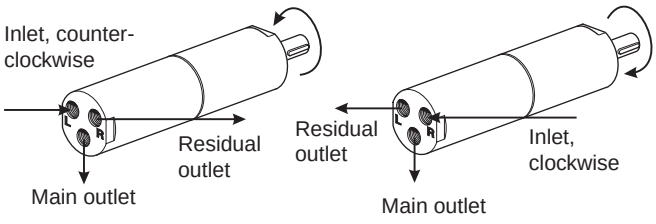
Start off on the curve at the pressure used and then look up to the lines for power, torque, air consumption or speed. Read off the correction factor on the Y axis for each curve and multiply this by the specified catalog data in the table or data read from the torque and power graphs.

Example: at 4 bar supply pressure, the power is only 0,55 x power at 6 bar supply pressure.

This example shows how rapidly the power rating of a motor decreases as the supply pressure is reduced. Therefore, it is critical to ensure that the proper pressure is supplied at the inlet port of the motor.

Direction of Motor Rotation

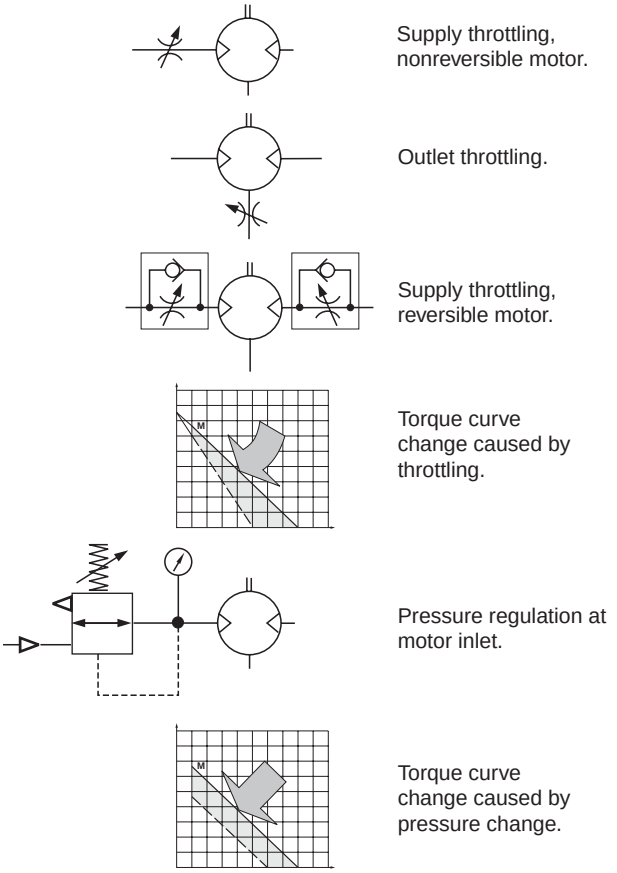
The direction of rotation of reversible motors is controlled by supplying inlet L or inlet R with compressed air. Air motors can be stopped and started continually without damage.



As the motor begins to rotate air is trapped between the vanes and is compressed. This air is exhausted through the exhaust port. As the rotor continues it's rotation, trapped air is compressed and exhausted through the residual port. If this air is not exhausted, the motor will be braked and maximum power will not be obtained.

Speed Regulation

Throttling



The most common way to reduce the speed of a motor is to install a flow control in the air inlet. When the motor is used in applications where it must reverse and it is necessary to restrict the speed in both directions, flow controls with integral non-return function should be used in both directions. Restriction may also be applied to the main outlet which will control the speed in both directions.

Inlet Throttling

If the inlet air is restricted, the air supply is restricted and the free speed of the motor falls, but there is full pressure on the vanes at low speeds. This means full torque is available from the motor at low speed, despite the low air flow.

Since the torque curve becomes “steeper”, this also means that we get a lower torque at any given speed than would be developed at full air flow.

Pressure Regulation

The speed and torque can also be regulated by installing a pressure regulator in the inlet pipe. When the motor is constantly supplied with air at lower pressure and the motor is braked, it develops a lower torque on the output shaft.

In brief: Inlet throttling gives reduced speed in one direction but maintains torque when braked. The torque curve becomes steeper. A restriction in the main inlet gives reduced speed in both directions but maintains torque when braked. The torque curve becomes steeper. Pressure regulation in the inlet cuts torque when the motor is braked, and also reduces speed. The torque curve is moved parallel.

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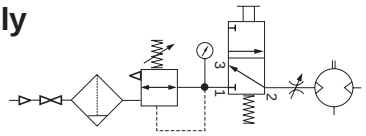
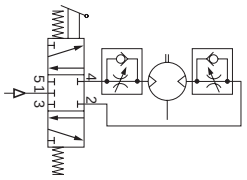
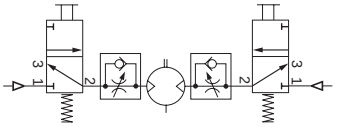
Air Supply



Shut-off, filtering, pressure regulation and control valve



Reversible motor with 5/3 control valve



Reversible motor with two 3/2 control valves

The air supplying the motor must be filtered and regulated. Directional valves are needed to control the pressurized air which will cause the motor to rotate. These valves can be equipped with several means of actuation, such as electric, manual or pneumatic control. When the motor is used in a non-reversible application, it is sufficient to use a 2/2 or 3/2 valve for supply. Either one 5/3 or two 3/2 valves are needed for a reversible motor, to ensure that the motor gets its compressed air and the residual outlet is vented. A flow control can be installed in the inlet pipe to regulate the motor speed if the motor is not used as a reversible motor. One flow control with by-pass is needed to regulate each direction of rotation if the motor is used as a reversible motor. The built-in check valve will then allow air from the residual air outlet to escape through the outlet port in the control valve.

The compressed air supply must have sufficiently large pipes and valves to give the motor maximum power. The motor needs 6 bar at the supply port all the time. A reduction of pressure to 5 bar reduces the power developed to 77%, and to 55% at 4 bar.

Choice of Components for Air Supply

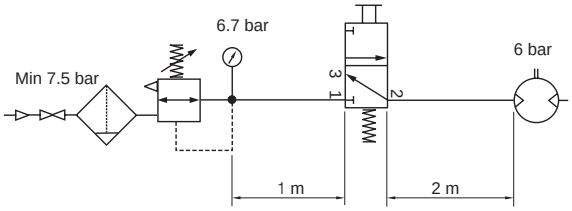
Since the supply pressure at the air motor inlet port is of considerable importance for obtaining the power, speed and torque quoted in the catalog, the recommendations below should be observed.

The following data must be complied with:

Supply pressure to air treatment unit:	Min 7.5 bar
Gauge pressure:	6.7 bar
Pipe length between air treatment unit and valve:	Max. 1 m
Pipe length between valve and air motor:	Max. 2 m

The pressure drop through air treatment unit - pipe - valve - pipe means that 6 bar pressure is obtained at the motor inlet port.

Please refer to the correction diagram on page K5, which shows what lower supply pressure means for power, speed and torque.



The Table can be used as follows:

If you are using only one motor with each air treatment unit and valve, simply follow the table. If you are using more than one motor with the same air treatment unit: read the table values for selecting the air treatment unit and add them together, and select a suitable air treatment unit from the table showing air flows per treatment unit. Then read the values for selecting the valve from the bottom of the table, and select a suitable valve from the table showing air flows per valve family.

The air treatment units have the following flows in Nl/Min at 7.5 bar supply pressure and 0,8 bar pressure drop

FRL Series	Air Flow in Nl/Min
P3H, Moduflex FRL, 40 Series, G1/4	550
P3K, Moduflex FRL, 60 Series, G1/2	1310
P3M, Moduflex FRL, 80 Series, G1	2770
Standard Series FRL, G11/2	9200
Stainless Series FRL PF, G1/4	530
Stainless Series FRL PF, G1/2	1480

Valve series with respective flows in Nl/minute

Valve Series	Qn in Nl/Min
Valvetronic Solstar	33
Interface PS1	100
Adex A05	173
Moduflex Size 1, (2 x 3/2)	220
Valvetronic PVL-B 5/3 Closed Center, 6 mm Push-In	290
Moduflex Size 1, (4/2)	320
B43 Manual and Mechanical	340
Valvetronic PVL-B 2 x 2/3, 6 mm Push-In	350
Valvetronic PVL-B 5/3 Closed Center, G1/8	370
Compact Isomax DX02	385
Valvetronic PVL-B 2 x 3/2 G1/8	440
Valvetronic PVL-B 5/2, 6 mm Push-In	450
Valvetronic PVL-B 5/3 Vented Center, 6 mm Push-In	450
Moduflex Size 2, (2 x 3/2)	450
Flowstar P2V-A	520
Valvetronic PVL-B 5/3 Vented Center, G1/8	540
Valvetronic PVL-B 5/2, G1/8	540
Valvetronic PVL-C 2 x 3/2, 8 mm Push-In	540
Adex A12	560
Valvetronic PVL-C 2 x 3/2 G1/8	570
Compact Isomax DX01	585
VIKING Xtreme P2LAX	660
Valvetronic PVL-C 5/3 Closed Center, 8 mm Push-In	700
Valvetronic PVL-C 5/3 Vented Center, G1/4	700
B3-Series	780
Valvetronic PVL-C 5/3 Vlosed Venter, G1/4	780
Moduflex size 2, (4/2)	800
Valvetronic PVL-C 5/2, 8 mm push in	840
Valvetronic PVL-C 5/3 Vented Center, 8 mm Push-In	840
Valvetronic PVL-C 5/2, G1/4	840
Flowstar P2V-B	1090
ISOMAX DX1	1150
B53 Manual and Mechanical	1160
B4-Series	1170
VIKING Xtreme P2LBX	1290
B5-Series, G1/4	1440
Airline Isolator Valve VE22/23	1470
ISOMAX DX2	2330
VIKING Xtreme P2LCX, G3/8	2460
VIKING Xtreme P2LDX, G1/2	2660
ISOMAX DX3	4050
Airline Isolator Valve VE42/43	5520
Airline Isolator Valve VE82/83	13680

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Air Motors

Air Motor	P1V-S002	P1V-S008	P1V-S012	P1V-S020	P1V-S030	P1V-S060	P1V-S120
Air flow required, Nl/s	1.7	3.8	5.0	6.3	8.0	14.5	27
Air flow required, Nl/min	102	230	300	380	480	870	1620
Min. internal diameter of pipe, mm	4	4	6	10	10	12	19
Choice of air treatment unit: recommended min. air flow in litres/minute at 7,5 bar air supply and 0,8 bar pressure drop							
	110						
		255					
			330				
				420			
					530		
						960	
							1780
Choice of valve: recommended min. air flow in Qn in litres/minute (Qn is the flow through the valve at 6 bar supply pressure and 1 bar pressure drop over the valve).							
	123						
		280					
			360				
				440			
					660		
						1080	
							2160

Drilling Motors

Drilling Motor	P1V-S008	P1V-S017	P1V-S025	P1V-S040			
Air flow required, Nl/s	3.8	5,0	6.3	8.0			
Air flow required, Nl/min	230	300	380	480			
Min. internal diameter of pipe, mm	4	6	6	10			
Choice of air treatment unit: recommended min. air flow in litres/minute at 7.5 bar air supply and 0.8 bar pressure drop							
	255						
		330					
			420				
				530			
Choice of valve: recommended min. air flow in Qn in litres/minute (Qn is the flow through the valve at 6 bar supply pressure and 1 bar pressure drop over the valve).							
	280						
		360					
			440				
				580			

Grinding and Milling Motors

Motor	Grinding P1V-S009	Grinding P1V-S020	Milling P1V-S040				
Air flow required, Nl/s	2.0	6.3	8.0				
Air flow required, Nl/min	120	380	480				
Min. internal diameter of pipe, mm	4	6	10				
Choice of air treatment unit: recommended min. air flow in litres/minute at 7.5 bar air supply and 0.8 bar pressure drop							
	135						
		420					
			530				
Choice of valve: recommended min. air flow in Qn in litres/minute (Qn is the flow through the valve at 6 bar supply pressure and 1 bar pressure drop over the valve).							
	145						
		440					
			580				

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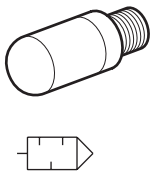
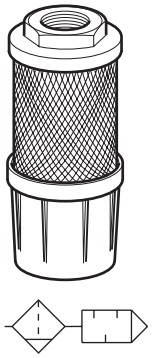
Silencing

Outlet silencer



Central silencer



The noise from an air motor consists of both mechanical noise and a pulsating noise from the air flowing out of the outlet. The installation of the motor has a considerable effect on mechanical noise. It should be installed so that no mechanical resonance effects occur. The outlet air creates a noise level which can amount to 108 dB(A) if the air is allowed to exhaust freely into the atmosphere. To reduce noise levels, various types of outlet silencer are used. The most common type screws directly into the outlet port of the motor. A wide range of silencers are available. Many are made of sintered brass or sintered plastic. Since the motor function causes the exhaust air to pulsate, it is a good idea to allow the air to exhaust into some kind of chamber first, which reduces the pulsations before they reach the silencer. The best silencing method is to connect a soft hose to a central silencer allowing the speed of the air to reduce as much as possible.

NOTE! *Remember that if a silencer is too small or is blocked, back pressure is generated on the outlet side of the motor, which in turn reduces the motor power.*

Sound Levels

Sound levels are measured at free speed with the measuring instrument positioned 1 m away from the air motor, see the table below.

Air Motor	Free Outlet dB (A)	With Outlet Silencer dB (A)	Exhaust Air Removed with Pipes to Another Room dB (A)
P1V-S002	98	—	74
P1V-S008	95	—	71
P1V-S012	99	92	70
P1V-S020	100	88	71
P1V-S030	103	91	70
P1V-S060	103	94	76
P1V-S120	108	95	87

Drilling, Milling and Grinding Motor	With Integrated Outlet Silencer dB (A)	Exhaust Air Removed with Pipes to Another Room dB (A)
P1V-S008	85	71
P1V-S009	72	—
P1V-S017	74	70
P1V-S025	76	71
P1V-S040	77	70

Compressed Air Quality

Oil and oil mist are avoided whenever possible to ensure a clean work environment. In addition, purchasing, installation and maintenance of oil mist equipment can be expensive. All users in all industries now try to avoid using components which have to be lubricated.

The P1V-S motor is equipped with vanes for intermittent lubrication free operation as standard, which is the most common application of air motors. The motor is also available with optional hard vanes for continuous lubrication-free operation (option “C”).

The P1V-S motor is equipped as standard with food grade grease in the planetary gearbox. An oil which is approved by the food industry is also available if supplementary lubrication is required.

Working pressure	Max. 7 bar (Max. 6 bar in explosive atmospheres Ex)
Working temperature	-30 °C to +100 °C
Ambient temperature	-20 °C to +40 °C in explosive atmospheres Ex
Medium	40 µm filtered, oil mist or dry unlubricated compressed air

Dry Unlubricated Compressed Air

If unlubricated compressed air is used, the compressed air should comply with the purity standards below in order to guarantee the longest possible overall service life. If the unlubricated compressed air has a high water content, condensation forms inside the motor, causing corrosion in all internal components. A ballbearing can be destroyed in a remarkably short time if it comes into contact with a single water droplet.

For indoor use, we recommend ISO8573-1 purity class 3.4.1. To achieve this, compressors must be fitted with aftercoolers, oil filters, refrigerant air dryers and air filters.

For indoor / outdoor use, we recommend ISO8573-1 purity class 1.2.1. To achieve this, compressors must be fitted with aftercoolers, oil filters, adsorption dryers and dust filters.

Oil Mist

If oil mist is used (approx. 1 drop of oil per m³ of compressed air), the oil not only acts as a lubricant but also protects against corrosion. This means that compressed air with a certain water content may be used without causing corrosion problems inside the motor.

ISO8573-1 purity class 3.-.5 may be used without difficulty.

The following oils are recommended for use in the foodstuffs industry: Shell Cassida Fluid HF 32 or Klüberoil 4 UH 1-32

ISO 8573-1 Purity Classes

Quality Class	Contaminants		Water	Oil
	Particle Size (µm)	Max. Concentration (mg/m³)	Max. Pressure Dew Point (°C)	Max. Concentration (mg/m³)
1	0.1	0.1	-70	0.01
2	1	1	-40	0.1
3	5	5	-20	1.0
4	15	8	+3	5.0
5	40	10	+7	25
6	—	—	+10	—

For example: compressed air to purity class 3.4.3

This means a 5 µm filter (standard filter), dew point +3 ºC (refrigerant cooled) and an oil concentration of 1,0 mg oil/m³ (as supplied by a standard compressor with a standard filter).

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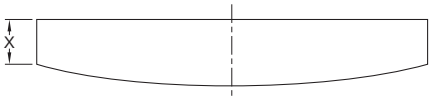
Service Interval

The first service is due after approximately 500 hours of operation. After the first service, the service interval is determined by the degree of vane wear*. The table below shows new dimensions and the minimum dimensions of worn vanes.

The following normal service intervals should be applied to in order to guarantee problem-free operation in air motors working continuously at load speeds*.



Air Motor	Dimensions on New Vanes X(Mm), Type of Vanes			
	Standard	Z	C	M
P1V-S002	3.3	–	–	–
P1V-S008	4.3	–	–	–
P1V-S012	4.2	4.2	4.2	4.2
P1V-S020	6.5	6.0	6.0	6.0
P1V-S030	6.8	6.2	6.8	6.2
P1V-S060	9.0	9.0	9.0	9.0
P1V-S120	14.7	14.0	14.0	14.0

Air Motor	Minimum Dimensions on Vane X (mm), Type of Vanes			
	Standard	Z	C	M
P1V-S002	3.0	–	–	–
P1V-S008	4.0	–	–	–
P1V-S012	3.3	3.3	3.3	3.3
P1V-S020	5.8	5.3	5.3	5.3
P1V-S030	6.0	5.2	6.0	5.2
P1V-S060	6.0	6.0	6.0	6.0
P1V-S120	14.2	13.5	13.5	13.5

Drilling, Milling and Grinding Motor	New Dimensions X(Mm)	Minimum Dimensions X (Mm)
P1V-S008	4.3	4.0
P1V-S017	4.2	3.3
P1V-S025	6.5	5.8
P1V-S040	6.8	6.0

Intermittent lubrication-free operation of motors with standard vanes

Duty cycle :	70%
Max. duration of intermittent use :	15 minutes
Filtration 40 µm :	750 hours of operation*
Filtration 5 µm :	1 000 hours of operation*

Continuous operation of motors with standard vanes, with lubrication

Duty cycle :	Continuous
Quantity of oil :	1 drop per m³ of air
Filtration 40 µm :	1 000 hours of operation*
Filtration 5 µm :	2 000 hours of operation*

NOTE! After 1000 hours of operation, the grease in the planetary gearbox must be changed

Continuous lubrication-free operation of motors equipped with hard vanes (option C)

Duty cycle :	Continuous
Filtration 40 µm :	750 hours of operation*
Filtration 5 µm :	1000 hours of operation*

CE marking

The air motors are supplied as “Components for installation” – the installer is responsible for ensuring that the motors are installed safely in the overall system. Parker Pneumatic guarantees that its products are safe, and as a supplier of pneumatic equipment we ensure that the equipment is designed and manufactured in accordance with the applicable EU directive.

Most of our products are classed as components as defined by various directives, and although we guarantee that the components satisfy the fundamental safety requirements of the directives to the extent that they are our responsibility, they do not usually carry the CE mark. Nevertheless, most P1V-S motors carry the CE mark because they are ATEX certified (for use in explosive atmospheres).

The following are the currently applicable directives:

- Machinery Directive (essential health and safety requirements relating to the design and structure of machines and safety components)
- EMC Directive
- Simple Pressure Vessels Directive
- Low Voltage Directive
- ATEX Directive (ATEX = ATmosphere EXplosive)

*The specified hours of operation apply when the motor is running at the speed corresponding to maximum power (load speed). This is approximately half free speed.

If the motor operates at higher speeds, the service interval is shorter.

If the motor operates at lower speeds, the service interval is longer.

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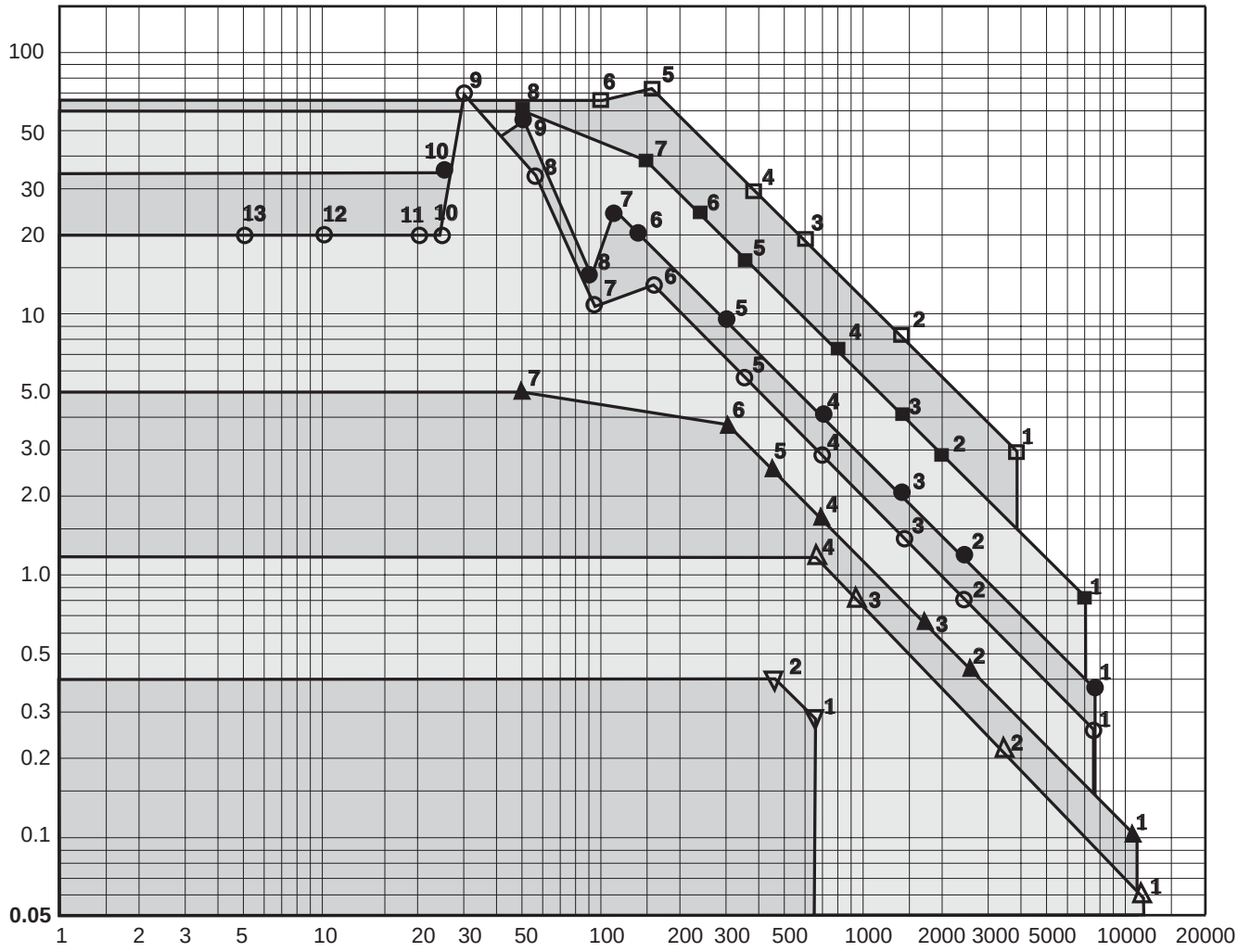
Choice of Air Motor

Torque at Maximum Power [Nm]



The motor to be used should be selected by starting with the torque needed at a specific shaft speed. In other words, to choose the right motor, you have to know the required speed and torque. Since maximum power is reached at half the motor's free speed, the motor should be chosen so that the oprating point is as close as possible to the maximum power of the motor.

The design principle of the motor means that higher torque is generated when it is braked, which tends to increase the speed, etc. This means that the motor has a kind of speed self-regulation function built in.

Use the above graph to choose the correct motor size. The graph contains the points for the maximum torque of each motor at maximum output. Add your operating point to the graph, then select a marked point above and to the right of your point.

Then use the correct working diagram of the chosen motor to get more detailed technical data. Always select a motor whose requisite technical data are in the shaded area. Also use the correction diagram to find out what operation with different supply pressures would mean for the motor.

Tip: Select a motor which is slightly too fast and powerful, then regulate its speed and torque with a pressure regulator and/or throttle to achieve the optimum working point.

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Air Motors in Diagram on Previous Page

20 Watt

▽ 1	P1V-S002A0130
▽ 2	P1V-S002A0095

Graphs for each motor, see page K19

P1V-S002A

80 Watt

△ 1	P1V-S008A0Q00
△ 2	P1V-S008A0700
△ 3	P1V-S008A0190
△ 4	P1V-S008A0130

Graphs for each motor, see page K19.

P1V-S008A

120 Watt

▲ 1	P1V-S012A0N00, P1V-S012D0N00
▲ 2	P1V-S012A0550, P1V-S012D0550
▲ 3	P1V-S012A0360, P1V-S012D0360
▲ 4	P1V-S012A0140, P1V-S012D1400
▲ 5	P1V-S012A0090, P1V-S012D0090
▲ 6	P1V-S012A0060, P1V-S012D0060
▲ 7	P1V-S012A0010, P1V-S012D0010

Graphs for each motor, see page K21.

P1V-S012A

P1V-S012D

200 Watt

○ 1	P1V-S020A0E50, P1V-S020D0E50
○ 2	P1V-S020A0460, P1V-S020D0460
○ 3	P1V-S020A0240, P1V-S020D0240
○ 4	P1V-S020A0140, P1V-S020D0140
○ 5	P1V-S020A0070, P1V-S020D0070
○ 6	P1V-S020A0035, P1V-S020D0035
○ 7	P1V-S020A0018, P1V-S020D0018
○ 8	P1V-S020A0011
○ 9	P1V-S020A0006
○ 10	P1V-S020A0005, P1V-S020D0005
○ 11	P1V-S020A0002
○ 12	P1V-S020A0001
○ 13	P1V-S020A00005

Graphs for each motor, see page K23.

P1V-S020A

P1V-S020D

300 Watt

● 1	P1V-S030A0E50, P1V-S030D0E50
● 2	P1V-S030A0460, P1V-S030D0460
● 3	P1V-S030A0240, P1V-S030D0240
● 4	P1V-S030A0140, P1V-S030D0140
● 5	P1V-S030A0060, P1V-S030D0060
● 6	P1V-S030A0028, P1V-S030D0028
● 7	P1V-S030A0023
● 8	P1V-S030A0018, P1V-S030D0018
● 9	P1V-S030A0010
● 10	P1V-S030A0005, P1V-S030D0005

Graphs for each motor, see page K25.

P1V-S030A

P1V-S030D

600 Watt

■ 1	P1V-S060A0E00
■ 2	P1V-S060A0400
■ 3	P1V-S060A0270
■ 4	P1V-S060A0170
■ 5	P1V-S060A0072
■ 6	P1V-S060A0048
■ 7	P1V-S060A0030
■ 8	P1V-S060A0010

Graphs for each motor, see page K27.

P1V-S060A

1200 Watt

□ 1	P1V-S120A0800
□ 2	P1V-S120A0270
□ 3	P1V-S120A0110
□ 4	P1V-S120A0078
□ 5	P1V-S120A0032
□ 6	P1V-S120A0012

Graphs for each motor, see page K29.

P1V-S120A

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Air Motors

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Technical Data

Working pressure	Max. 7 bar (Max. 6 bar in explosive atmospheres)
Working temperature	-30 °C to +100 °C
Ambient temperature	-20 °C to +40 °C in explosive atmospheres
Medium	40 µm filtered, oil mist or dry unlubricated compressed air

Table and Diagram Data

All values are typical values, with a tolerance of ±10%

Option

Other variants on request

Material Specification

Planetary gearbox for:
P1V-S060A0010 /30 /48
P1V-S120A0012 /32 Stainless steel, X46Cr13

Planetary gearbox for last planet stage incl. installation flange
P1V-S020A0011 /06
P1V-S030A0023 /10 Black oxidised steel (not stainless)

All other housings Stainless steel, X12CrMoS17

Spindle* Hardened stainless steel, X20Cr13
Key* Hardened stainless steel X6CrNiMoTi17-12-2
External seal Fluor rubber, FPM
Internal steel parts High grade steel (not stainless)
Planetary gear grease USDA-h1 approved

* P1V-S020A0011/06 and P1V-S030A0023/10
Key and Shaft High grade steel (not stainless)
Screws in housing in last planet stage Surface treated steel (not stainless)

Flange bracket Stainless steel, X12CrMoS17
Foot bracket Stainless steel, X5CrNi18
Screws for bracket Stainless steel DIN A2

Choice of Vanes

0 = Standard

Standard vanes = These motors are of the vane type for intermittent lubrication-free operation. They can operate 70% of the time for up to 15 minutes without lubrication. With lubrication, these motors can operation 100% of the time.

Z = Spring Loaded (Standard) Vanes

Standard vanes = These motors are of the vane type for intermittent lubrication-free operation. They can operate 70% of the time for up to 15 minutes without lubrication. With lubrication, these motors can operation 100% of the time.
Spring loaded vanes = All vanes are spring loaded to ensure that they remain pressed against the cylinder when the motor stops. The spring loaded vane option also prevents the vanes from sliding down in their track if vibration is introduced. The spring loaded vanes therefore provide a higher starting torque, improved starting and low speed characteristics, because the leakage over the vanes is reduced to a minimum.

C = Vanes for Continuous Lubrication-Free Operation

C vanes = This motor is equipped with vanes for continuous lubrication-free operation. (To obtain the longest possible service life, we recommend no oil in the air.)

M = Multi (Combination of Z+C)

C vanes = This motor is equipped with vanes for continuous lubrication-free operation. (To obtain the longest possible service life, we recommend no oil in the air.)
Spring loaded vanes = All vanes are spring loaded to ensure that they remain pressed against the cylinder when the motor stops. The spring loaded vane option also prevents the vanes from sliding down in their track if vibration is introduced. The spring loaded vanes therefore provide a higher starting torque, improved starting and low speed characteristics, because the leakage over the vanes is reduced to a minimum.

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Order Key

P1V-S **020** **A** **0** **E50**

	Air Motor Range
P1V-S	Stainless Vane Motor

	Motor Size
002	20 W
008	80 W
012	120 W
020	200 W
030	300 W
060	600 W
120	1200 W

	Function
A	Keyed Shaft, Reversible
D	Threaded Shaft, Reversible

	Optional Functions
0	Standard
C*	Continuous Lubrication-Free Operation
Z*	Spring Loaded Vanes
M*	Multi: Combination of C+Z
D**	Standard with Brake
E**	Option C with Brake
F**	Option Z with Brake
G**	Option M with Brake

* Not for P1V-S002 and P1V-S008

** Only for P1V-S020 and P1V-S030

	Free Speed per min
0005	5
001 | **999**	10 | 9990
A00 | **E00**	10000 | 14000
E50 | **N00**	14500 | 22000
Q00	24000

Possible combinations

Please refer to pages K18 to K32.

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Introduction to the ATEX directive

Explosive Atmospheres

Directive 94/9/EC defines an explosive atmosphere as a mixture of:

a) **flammable substances** – gases, vapors, mists or dusts
b) with air
c) under specific **atmospheric conditions**
d) in which, after ignition has occurred, combustion spreads to the entire flammable mixture

(NB: with regard to dust, it may be that not all dust is combusted after ignition has occurred)

An atmosphere with the potential to become an explosive atmosphere during operating conditions and/or under the influence of the surroundings is defined as a **potentially explosive atmosphere.** Products covered by directive 94/9/EC are defined as intended for use in potentially explosive atmospheres.

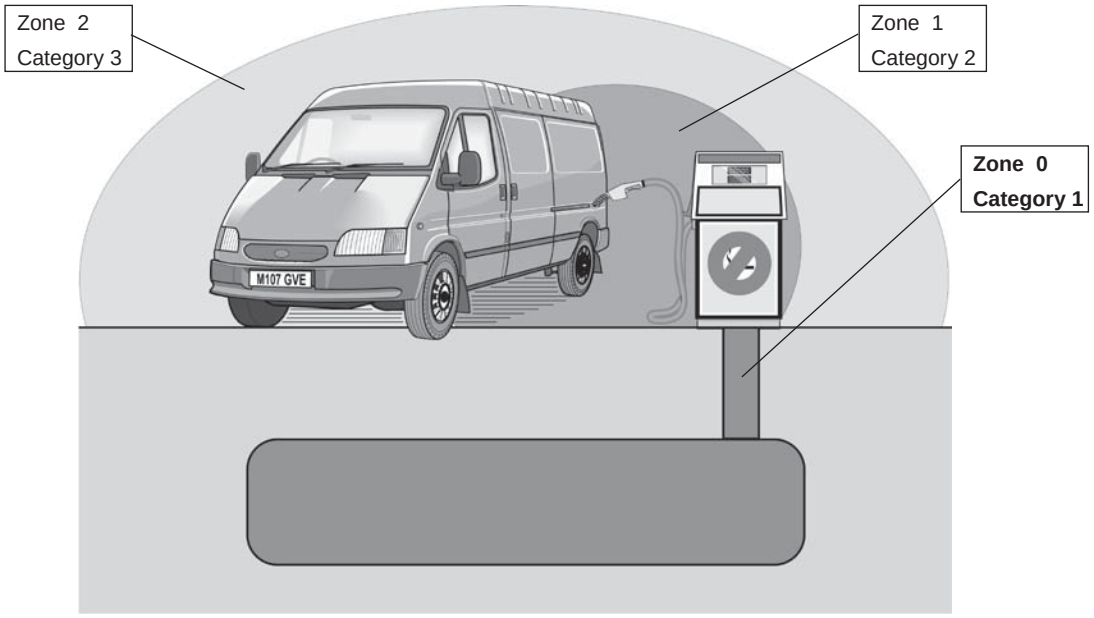
Harmonised European ATEX Standard

The European Union has adopted two harmonised directives in the field of health and safety. The directives are known as ATEX 100a and ATEX 137.

Directive ATEX 100a (94/9/EC) lays down minimum safety requirements for products intended for use in potentially explosive atmospheres in European Union member states. Directive ATEX 137 (99/92/EC) defines minimum requirements for health and safety at the workplace, for working conditions and for the handling of products and materials in potentially explosive atmospheres. This directive also divides the workplace into **zones** and defines criteria by which products are **categorized** within these zones.

The table below describes the **zones** in an installation where there is a potential for explosive atmospheres. The **owner** of the installation must analyse and assess the area in which the explosive gas/dust mixture may occur, and if necessary must divide it into **zones**. This process of zoning then allows the correct plant and equipment to be selected for use in the area.

The ATEX directive has been in force throughout the European Union since 1 July 2003, replacing the existing divergent national and European legislation relating to explosive atmospheres.



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Zones Gas G	Zones Dust D	Presence of Potentially Explosive Atmosphere	Type of risk
0	20	Present continuously or for long periods	Permanent
1	21	Likely to occur in normal operation occasionally	Potential
2	22	Not likely to occur in normal operation but, if it does occur, will persist for a short period only	Minimal

Please note that for the first time, the directive covers mechanical, hydraulic and pneumatic equipment and not just electrical equipment as before.

With regard to the **Machinery Directive** 98/37/EC, note that a number of external requirements in 94/9/EC refer to hazards arising from potentially explosive atmospheres, where the Machinery directive only contains general requirements relating to explosion safety (Annex I 1.5.7).

As a result, directive 94/9/EC (ATEX 100a) takes precedence over the Machinery directive with regard to explosion protection in potentially explosive atmospheres. The requirements in the Machinery directive are applicable to all other risks relating to machinery.

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Levels of Protection for the Various Equipment Categories

The various equipment categories must be capable of operating in accordance with the manufacturer's operating specifications at defined levels of protection.

Level of Protection	Category Group I	Category Group II	Type of protection	Operating Specifications
Very high	M1		Two independent means of protection or safety, ensuring that the equipment remains functional even in the event of two faults occurring independently of each other	The equipment remains energised and and functional even with an explosive atmosphere present
Very high		1	Two independent means of protection or safety, ensuring that the equipment remains functional even in the event of two faults occurring independently of each other	The equipment remains energised and functional in zones 0, 1, 2 (G) and/or zones 20, 21, 22 (D)
High	M2		Protection suitable for normal operation and severe operating conditions	The equipment is de-energised in the event of an explosive atmosphere
High		2	Protection suitable for normal operation and frequent faults, or equipment in which faults normally have to be taken into account	The equipment remains energised and functional in zones 1, 2 (G) and/or zones 21, 22 (D)
Normal		3	Protection suitable for normal operation	The equipment remains energised and functional in zones 2 (G) and/or zones 22 (D)

Definition of Groups (EN 1127-1)

Group I Equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by flammable vapors and/or flammable dusts.

Group II Equipment intended for use in other places exposed to explosive atmospheres.

Group	I Mines, Combustible Vapors		II Other Potentially Explosive Atmospheres (Gases, Dust)					
Category	**M1**	**M2**	**1**		**2**		**3**	
Atmosphere*			G	D	G	D	G	D
Zone			0	20	1	21	2	22

G = gas and D = dust

Temperature Classes

Classification of flammable gases and vapors on the basis of ignition temperature

Temperature Class	Ignition Temperature °C
T1	Over 450
T2	(300) – 450
T3	(200) – 300
T4	(135) – 200
T5	(100) – 135
T6	(85) - 100

Declaration of Conformity

The product catalogs contain copies of the declaration of conformity demonstrating that the product meets the requirements of directive 94/9/EC.

The declaration is only valid in conjunction with the instructions contained in the installation manual relating to the safe use of the product throughout its service life.

The instructions relating to the conditions in the surrounding area are particularly important, as the certificate is invalidated if the instructions are found not to have been adhered to during operation of the product.

If there is any doubt as to the validity of the certificate of conformity, contact Parker Hannifin customer service.

Operation, Installation and Maintenance

The installation manual of the product contains instructions relating to the safe storage, handling, operation and servicing of the product.

The manual is available in different languages, and can be downloaded from **www.parker.com/euro_pneumatic**.

This document must be made accessible in a suitable place near where the product is installed. It is used as a reference for all personnel authorized to work with the product throughout its service life.

We, the manufacturer, reserve the right to modify, extend or improve the installation manual in the interests of the users.

For more information about ATEX see EUs homepage: **http://europa.eu.int/comm/enterprise/atex/**

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Additional Safety Instructions For Installation In Explosive Atmospheres

SERIOUS, EVEN FATAL, DAMAGE OR INJURY MAY BE CAUSED BY THE HOT MOVING PARTS OF THE P1V-S MOTORS IN THE PRESENCE OF EXPLOSIVE GAS MIXTURES AND CONCENTRATIONS OF DUST.

All installation, connection, commissioning, servicing and repair work on P1V-S motors must be carried out by qualified personnel taking account of the following

- These instructions
- Notices on the motor
- All other planning documents, commissioning instructions and connection diagrams associated with the application.
- Provisions and requirements specific to the application
- Applicable national/international regulations (explosion protection, safety and accident prevention)

Real Life Applications

P1V-S motors are designed to provide rotary movement in industrial applications, and should only be used in accordance with the instructions in the technical specifications in the catalog, and within the operating range indicated on the motor housing. The motors meet the applicable standards and requirements of the Machinery Directive 94/9/EC (ATEX)

The Motors Must Not Be Used As Brakes In Explosive Atmospheres.
Braking involves driving the motor against the direction of rotation for which the motor is supplied with compressed air. The motor is then operating as a compressor, and there is a corresponding increase in temperature.

The motors must **not** be used underground in mines susceptible to firedamp and/or combustible dust. The motors are intended for use in areas in which explosive atmospheres caused by gases, vapors or mists of combustible liquids, or air/dust mixtures may be expected to occur during normal use (infrequently)

Checklist

Before using the motors in a potentially explosive atmosphere, you should check the following:

Do the motor specifications match the classification of the area of use in accordance with Directive 94/9/EG (previously ATEX 100a)

- Equipment group
- Equipment category
- Zone
- Temperature class
- Max. surface temperature

1. When installing the motor, is it certain that there is no potentially explosive atmosphere, oil, acids, gases, vapors or radiation?
2. Is the ambient temperature as specified in the technical data in the catalog at all times?
3. Is it certain that the P1V-S motor is adequately ventilated and that no additional heat is added (for example in the shaft connection)?
4. Are all the driven mechanical components ATEX certified?

Installation Requirements In Potentially Explosive Atmospheres

- The temperature of the supply air must not exceed the ambient temperature.
- The P1V-S may be installed in any position.
- An air treatment unit must be attached to the inlet of the P1V-S air motor.
- In a potentially explosive atmosphere, none of the motor ports may be blocked because this may cause an increase in temperature. The air from the port must be taken to the silencer or, preferably, outside the potentially explosive area.
- The P1V-S motor must be connected to ground at all times, through its support, a metallic tube or separate conductor.
- The outlet of the P1V-S motor must not open within a potentially explosive area, but must be passed to the silencer or, preferably, removed and released outside the potentially explosive area.
- The P1V-S motor may only drive units that are ATEX certified.
- Ensure that the motor is not exposed to forces greater than those permitted in accordance with the catalog.

Measuring The Temperature On The Outside Of The P1V-S Motor (Only When Used In Potentially Explosive Areas)

During the commissioning process, it is essential to measure temperature increases at the indicated positions on the outside of the P1V-S motor.
These measurements can be taken using standard thermometers.

Checking The Motor During Operation

The motor must be kept clean on the outside, and a layer of dirt thicker than 5 mm must never be allowed to form.
Strong solvents should not be used for cleaning, because they can cause the seal (material NBR/FPM) around the drive shaft to swell, potentially increasing the temperature.

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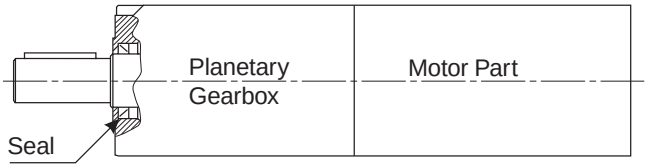
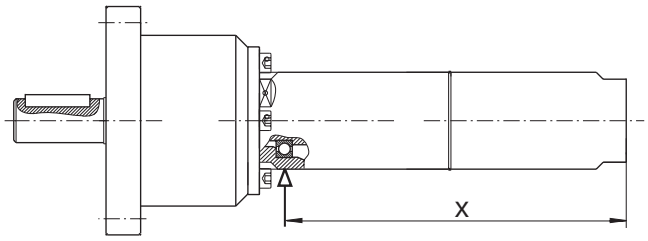
For The P1V-S012, P1V-S020, P1V-S030 and P1V-S060 Series

The temperature is measured on the metal surface next to the seal around the output shaft on all P1V-S012, P1V-S020, P1V-S030 and P1V-S060 motors



Motors P1V-S020A0011, P1V-S020A0006, P1V-S030A0023 and P1V-S030A0010



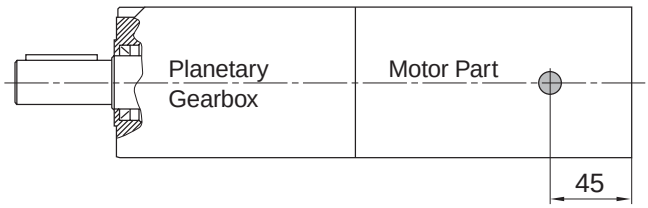
Motor	x [mm]
P1V-S020A0011	133
P1V-S020A0006	133
P1V-S030A0023	146
P1V-S030A0010	147,5

The maximum temperature is reached after approximately 1,5 hours of operation, and the difference in temperature between the motor and the ambient temperature must not exceed 40 °C.

If the temperature difference at the seal of a P1V-S012, P1V-S020, P1V-S030 or P1V-S060 exceeds 40 °C, you should stop the motor immediately and contact Parker Hannifin.

The following applies to the P1V-S120 series:

The temperature is measured on the metal surface at a point 45 mm from the port end of the motor housing, on all P1V-S120.



The maximum temperature is reached after approximately 1,5 hours of operation, and the difference in temperature between the motor and the ambient temperature must not exceed 55 °C.

If the temperature difference at this point on a P1V-S120 exceeds 55 °C, you should stop the motor immediately and contact Parker Hannifin.

Marking of Products

For all P1V-S012, P1V-S020, P1V-S030 and P1V-S060

CE Ex II2 GD c IIC T6 (80°C) X

For the P1V-S120

CE Ex II2 GD c IIC T5 (95°C) X

CE — **C**ommunatuté **E**uropéenne = EU
CE marking shows that as a manufacturer, Parker Hannifin meets the guidelines specified by the EU

Ex — **Ex** means that this product is intended for use in a potentially explosive area

II — stands for the equipment group (I = mines and II = other places liable to be endangered)

2GD — stands for equipment category
2G means the equipment can be used in zones 1 and 2 where there is a risk involving gas, vapour or mist of combustible liquids and **2D** in zones 21 and 22 where there is a risk involving dust .
2GD means the equipment can be used in zones 1, 2, 21 and 22.

c — Safe design (prEN 13463-5)

IIC — Explosion group, P1V-S air motors are tested to the highest standards in terms of test gases, and can be installed in the presence of all gases without restriction.

T6 — If equipment is in temperature class **T6**, the maximum surface temperature must not exceed 85°C. (To guarantee this, the product has been tested to ensure that the maximum is 80°C. This provides a safety margin of 5°K.)

T5 — If equipment is in temperature class **T5**, the maximum surface temperature must not exceed 100°C. (To guarantee this, the product has been tested to ensure that the maximum is 95°C. This provides a safety margin of 5°K.)

(80°C) — Maximum permitted surface temperature on the motor in atmospheres containing potentially explosive dust.

X — Note special conditions

Test certificate number IBExU04ATEXB004 X from IBExU Institut für Sicherheitstechnik GmbH, D-09599 Freiberg, Germany

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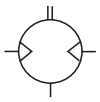
NOTE! All technical data is based on a working pressure of 6 bar.



Data For Reversible Air Motor With Keyed Shaft, P1V-S002A Series

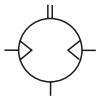
Max. Power	Free Speed	Speed At Max. Power	Torque At Max. Power	Min Start Torque	Air Consumption At Max. Power	Connector	Min. Pipe ID	Weight	Order Code
kW	rpm	rpm	Nm	Nm	l/s		mm	kg	
0.02	1300	650	0.29	0.44	1.7	M5	3	0.16	**P1V-S002A0130**
0.02	950	475	0.40	0.60	1.7	M5	3	0.16	**P1V-S002A0095**

NOTE! Not with vane options C, Z or M.

The P1V-S002A and P1V-S008A require oil mist for lubricating the gearbox.

Installation brackets, see page K33
Dimensions, see page K34
Permitted shaft loadings, see page K58
Service kits, see page K60

NOTE! All technical data is based on a working pressure of 6 bar.



Data For Reversible Air Motor With Keyed Shaft, P1V-S008A Series

Max. Power	Free Speed	Speed At Max. Power	Torque At Max. Power	Min Start Torque	Air Consumption At Max. Power	Connector	Min. Pipe ID	Weight	Order Code
kW	rpm	rpm	Nm	Nm	l/s		mm	Kg	
0.08	24000	12000	0.06	0.09	3.5	M8x0.75*	4	0.22	**P1V-S008A0Q00**
0.08	7000	3500	0.22	0.33	3.5	M8x0.75*	4	0.22	**P1V-S008A0700**
0.08	1900	950	0.80	1.20	3.5	M8x00.75*	4	0.22	**P1V-S008A0190**
0.08	1300	650	1.20	1.80	3.5	M8x0.75*	4	0.22	**P1V-S008A0130**

* 3 push in nipples (F28PMB6M8SP) for plastic pipe Ø6/4 supplied

NOTE! Not with vane options C, Z or M.

The P1V-S002A and P1V-S008A require oil mist for lubricating the gearbox.

Installation brackets, see page 35
Dimensions, see page K34
Permitted shaft loadings, see page K58
Service kits, see page K60

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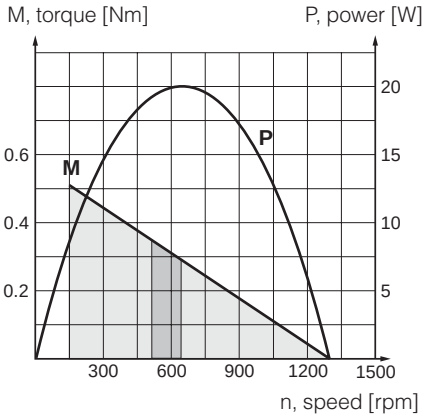
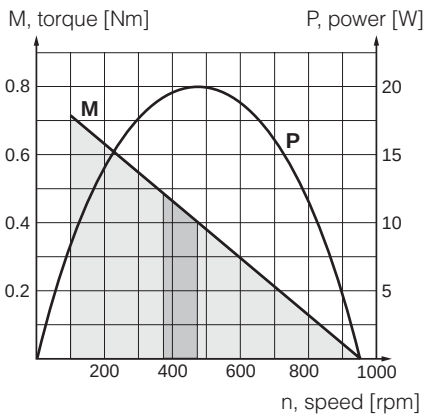
P1V-S002A0130



P1V-S002A0095



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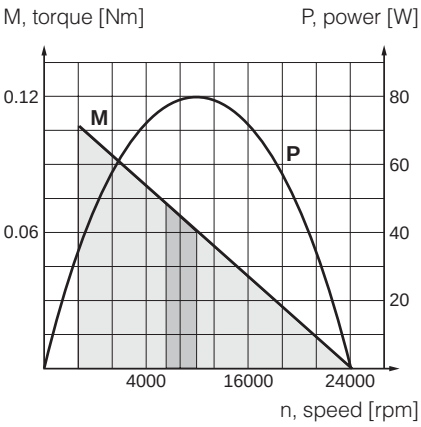
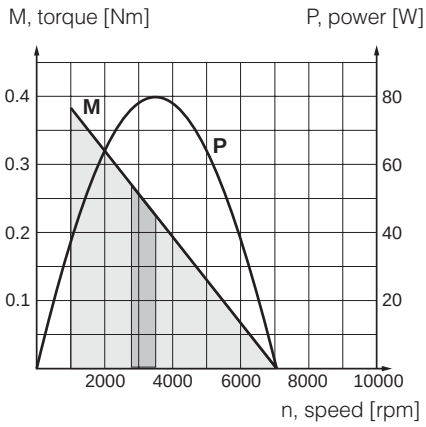
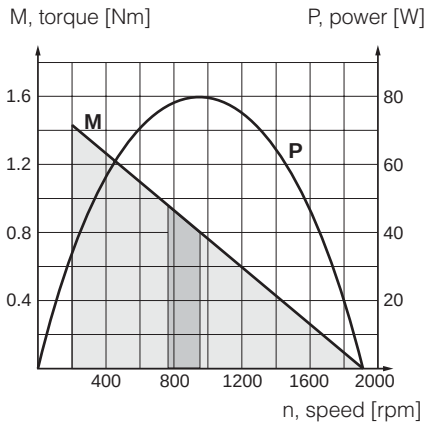


P1V-S008A0700



P1V-S008A0190



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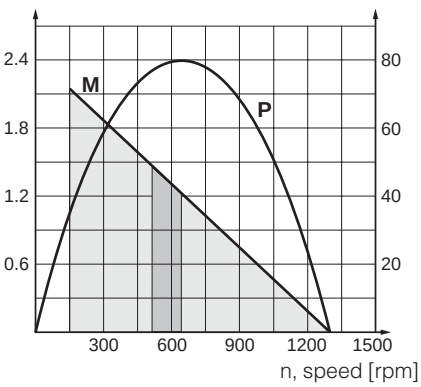

Possible working range of motor.

Optimum working range of motor.
Higher speeds = more vane wear
Lower speeds with high torque = more gearbox wear

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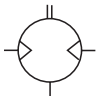
NOTE! All technical data is based on a working pressure of 6 bar.

CE Ex II2 GD c IIC T6 (80°C) X



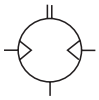
Data For Reversible Air Motor With Keyed Shaft, P1V-S012A Series

Max. Power	Free Speed	Speed At Max. Power	Torque At Max. Power	Min Start Torque	Air Consumption At Max. Power	Connector	Min. Pipe ID	Weight	Order Code
kW	rpm	rpm	Nm	Nm	l/s		mm	kg	
0.120	22000	11000	0.10	0.15	5.0	G1/8	6	0.350	**P1V-S012A0N00**
0.120	5500	2750	0.42	0.63	5.0	G1/8	6	0.350	**P1V-S012A0550**
0.120	3600	1800	0.64	0.95	5.0	G1/8	6	0.350	**P1V-S012A0360**
0.120	1400	700	1.64	2.40	5.0	G1/8	6	0.400	**P1V-S012A0140**
0.120	900	450	2.54	3.80	5.0	G1/8	6	0.400	**P1V-S012A0090**
0.120	600	300	3.82	5.00*	5.0	G1/8	6	0.400	**P1V-S012A0060**
0.090	100	50	5.00*	5.00*	5.0	G1/8	6	0.450	**P1V-S012A0010**

* Max. permitted torque

In all P1V-S012 motors, torques exceeding 5 Nm may cause damage to the gearbox (e.g. when driving against a fixed stop or large oscillating weight)

CE Ex II2 GD c IIC T6 (80°C) X



Data For Reversible Air Motor With Threaded Shaft, P1V-S012D Series

Max. Power	Free Speed	Speed At Max. Power	Torque At Max. Power	Min Start Torque	Air Consumption At Max. Power	Connector	Min. Pipe ID	Weight	Order Code
kW	rpm	rpm	Nm	Nm	l/s		mm	kg	
0.120	22000	11000	0.10	0.15	5.0	G1/8	6	0.350	**P1V-S012D0N00**
0.120	5500	2750	0.42	0.63	5.0	G1/8	6	0.350	**P1V-S012D0550**
0.120	3600	1800	0.64	0.95	5.0	G1/8	6	0.350	**P1V-S012D0360**
0.120	1400	700	1.64	2.40	5.0	G1/8	6	0.400	**P1V-S012D0140**
0.120	900	450	2.54	3.80	5.0	G1/8	6	0.400	**P1V-S012D0090**
0.120	600	300	3.82	5.00*	5.0	G1/8	6	0.400	**P1V-S012D0060**
0.090	100	50	5.00*	5.00*	5.0	G1/8	6	0.450	**P1V-S012D0010**

* Max. permitted torque

In all P1V-S012 motors, torques exceeding 5 Nm may cause damage to the gearbox (e.g. when driving against a fixed stop or large oscillating weight)

NOTE!

The P1V-S012D with threaded shaft may be reversed, but when operated counterclockwise, there is a risk that the driven unit may disconnect if it is not locked properly.

Installation brackets, see page K33
Dimensions, see page K35
Permitted shaft loadings, see page K58
Service kits, see page K60

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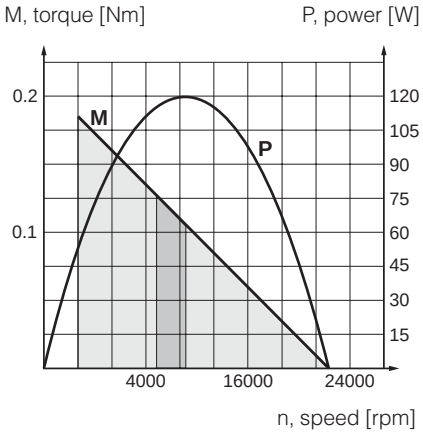
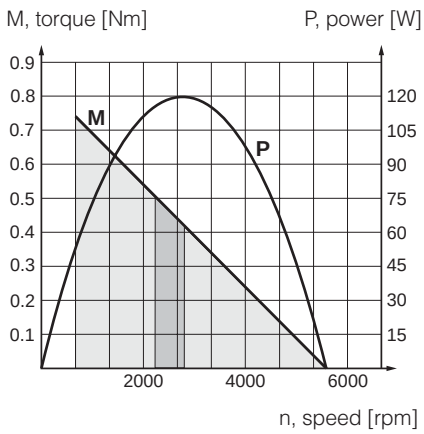
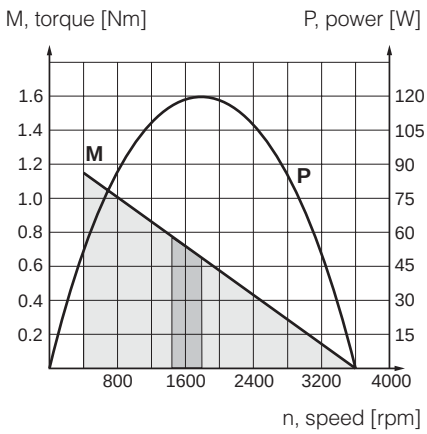
P1V-S012A0N00
P1V-S012D0N00



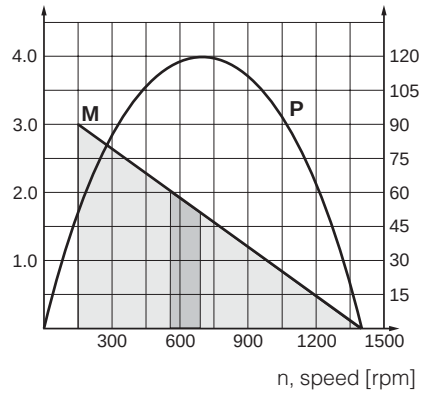
P1V-S012A0550
P1V-S012D0550



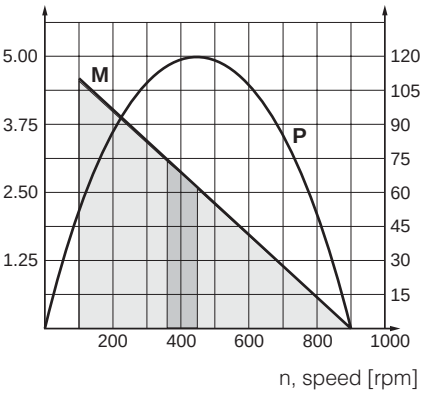
P1V-S012A0360
P1V-S012D0360



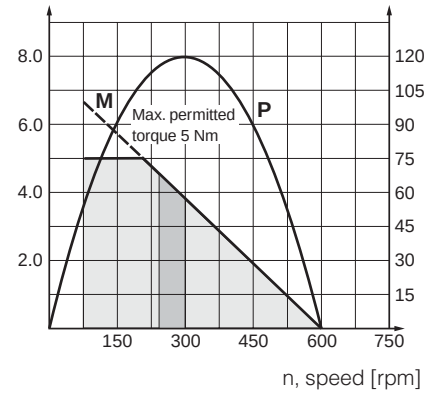
P1V-S012A0140
P1V-S012D0140



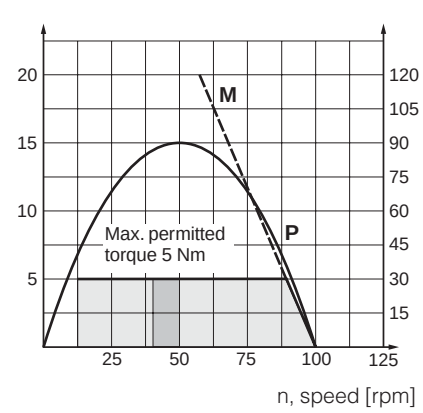
P1V-S012A0090
P1V-S012D0090



P1V-S012A0060
P1V-S012D0060



P1V-S012A0010
P1V-S012D0010



Possible working range of motor.

Optimum working range of motor.
Higher speeds = more vane wear
Lower speeds with high torque = more gearbox wear

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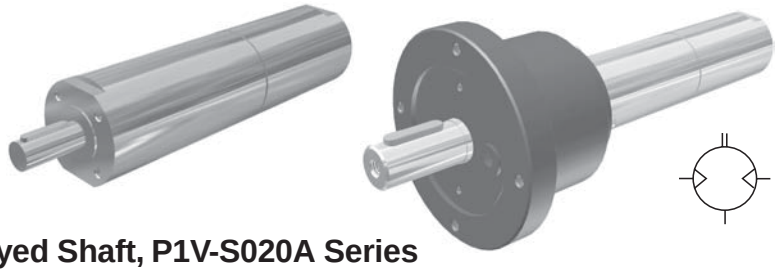
NOTE! All technical data is based on a working pressure of 6 bar.

CE Ex II2 GD c IIC T6 (80°C) X

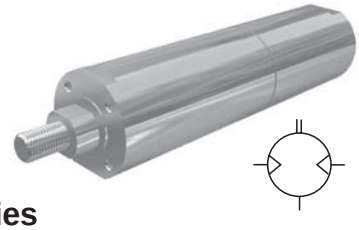


Data For Reversible Air Motor With Keyed Shaft, P1V-S020A Series

Max. Power	Free Speed	Speed At Max. Power	Torque At Max. Power	Min Start Torque	Air Consumption At Max. Power	Connector	Min. Pipe ID	Weight	Order Code
kW	rpm	rpm	Nm	Nm	l/s		mm	kg	
0.200	14500	7250	0.26	0.40	6.3	G1/8	10	0.700	**P1V-S020A0E50**
0.200	4600	2300	0.80	1.20	6.3	G1/8	10	0.750	**P1V-S020A0460**
0.200	2400	1200	1.60	2.40	6.3	G1/8	10	0.750	**P1V-S020A0240**
0.200	1400	700	2.70	4.10	6.3	G1/8	10	0.850	**P1V-S020A0140**
0.200	700	350	5.40	8.20	6.3	G1/8	10	0.850	**P1V-S020A0070**
0.200	350	160	12.00	18.00	6.3	G1/8	10	0.850	**P1V-S020A0035**
0.100	180	90	10.50	15.00	4.5	G1/8	10	0.850	**P1V-S020A0018**
0.200	110	55	33.00	49.50	6.3	G1/8	10	3.000	**P1V-S020A0011**
0.200	60	30	72.00	108.00*	6.3	G1/8	10	3.000	**P1V-S020A0006**
0.180	50	25	20.00*	20.00*	6.3	G1/8	10	0.950	**P1V-S020A0005**
0.180	20	–	20.00*	20.00*	6.3	G1/8	10	0.950	**P1V-S020A0002**
0.180	10	–	20.00*	20.00*	6.3	G1/8	10	1.050	**P1V-S020A0001**
0.180	5	–	20.00*	20.00*	6.3	G1/8	10	1.050	**P1V-S020A00005**

* Max. permitted torque

CE Ex II2 GD c IIC T6 (80°C) X



Data For Reversible Air Motor With Threaded Shaft, P1V-S020D Series

Max. Power	Free Speed	Speed At Max. Power	Torque At Max. Power	Min Start Torque	Air Consumption At Max. Power	Connector	Min. Pipe ID	Weight	Order Code
kW	rpm	rpm	Nm	Nm	l/s		mm	kg	
0.200	14500	7250	0.26	0.40	6.3	G1/8	10	0.700	**P1V-S020D0E50**
0.200	4600	2300	0.80	1.20	6.3	G1/8	10	0.750	**P1V-S020D0460**
0.200	2400	1200	1.60	2.40	6.3	G1/8	10	0.750	**P1V-S020D0240**
0.200	1400	700	2.70	4.10	6.3	G1/8	10	0.850	**P1V-S020D0140**
0.200	700	350	5.40	8.20	6.3	G1/8	10	0.850	**P1V-S020D0070**
0.200	350	160	12.00	18.00	6.3	G1/8	10	0.850	**P1V-S020D0035**
0.100	180	90	10.50	15.00	4.5	G1/8	10	0.850	**P1V-S020D0018**
0.180	50	25	20.00*	20.00*	6.3	G1/8	10	0.950	**P1V-S020D0005**

* Max. permitted torque

NOTE!

The P1V-S020D with threaded shaft may be reversed, but when operated counterclockwise, there is a risk that the driven unit may disconnect if it is not locked properly.

Installation brackets, see page K33
Dimensions, see page K36
Permitted shaft loadings, see page K58
Service kits, see page K60

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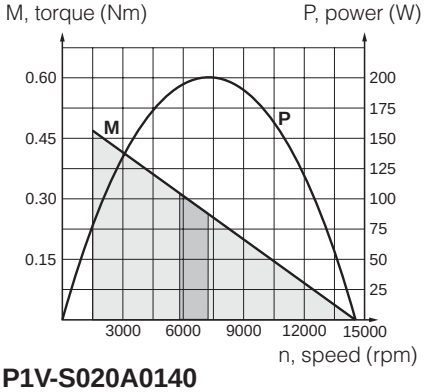
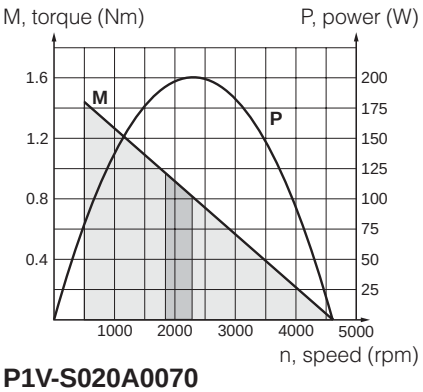
P1V-S020A0E50
P1V-S020D0E50



P1V-S020A0460,
P1V-S020D0460



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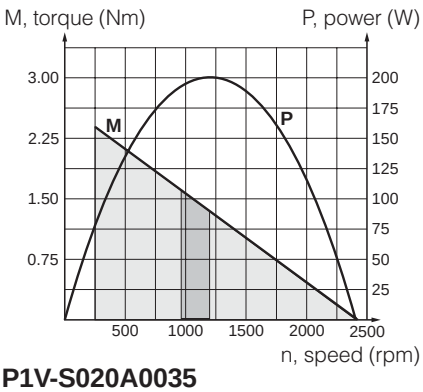
P1V-S020D0240



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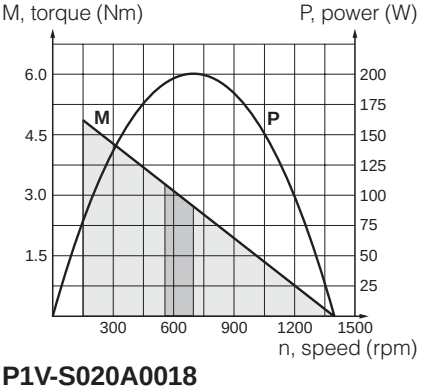
P1V-S020D0140



P1V-S020A0070
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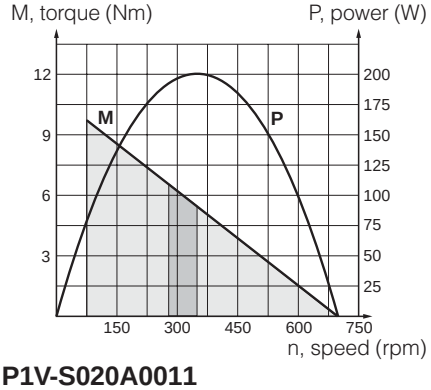
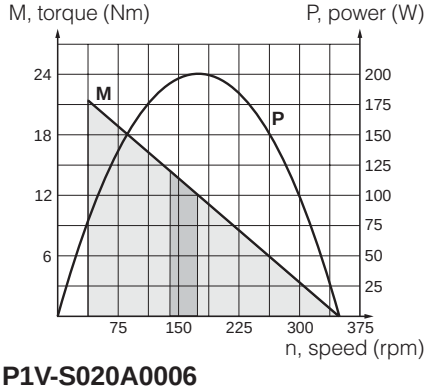
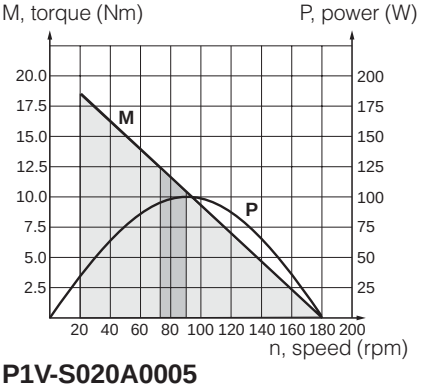


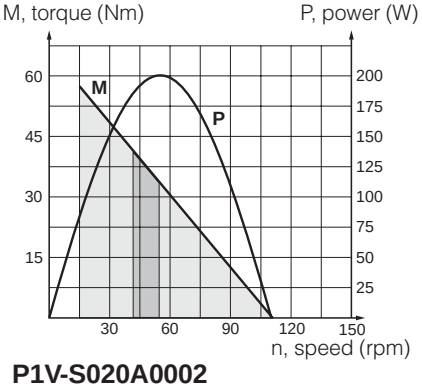
P1V-S020A0035
P1V-S020D0035



P1V-S020A0018
P1V-S020D0018



P1V-S020A0011



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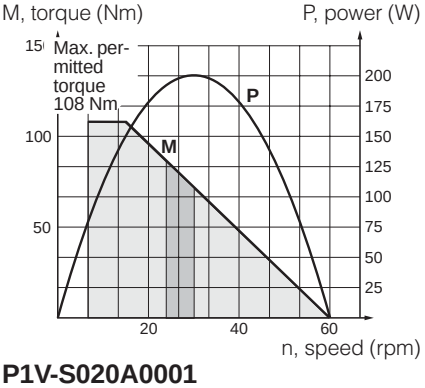

P1V-S020A0005
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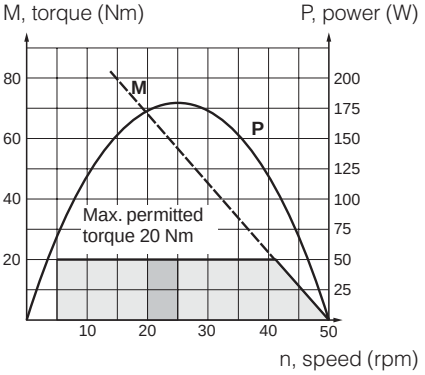

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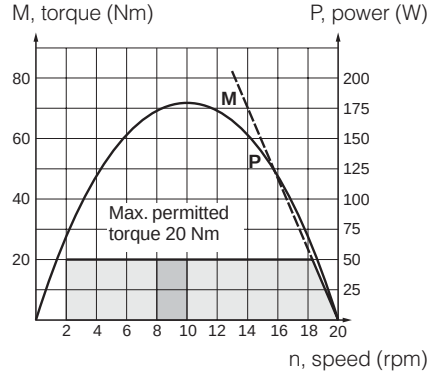
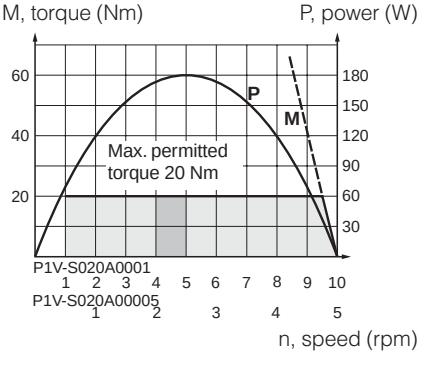


P1V-S020A0001
P1V-S020A00005



Possible working range of motor.

Optimum working range of motor.
Higher speeds = more vane wear
Lower speeds with high torque = more gearbox wear

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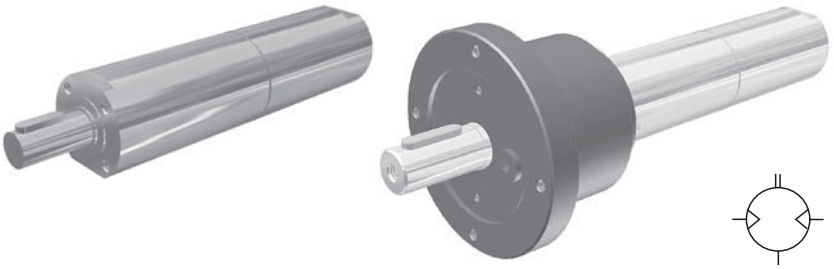
NOTE! All technical data is based on a working pressure of 6 bar.

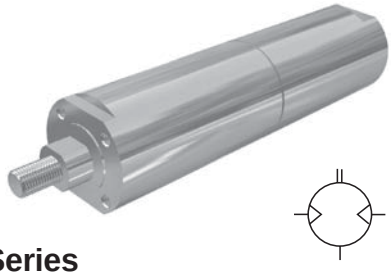
CE Ex II2 GD c IIC T6 (80°C) X



Data For Reversible Air Motor With Keyed Shaft, P1V-S030A Series

Max. Power	Free Speed	Speed At Max. Power	Torque At Max. Power	Min Start Torque	Air Consumption At Max. Power	Connector	Min. Pipe ID	Weight	Order Code
kW	rpm	rpm	Nm	Nm	l/s		mm	kg	
0.300	14500	7250	0.40	0.60	8.0	G1/4	10	1.000	**P1V-S030A0E50**
0.300	4600	2300	1.20	1.90	8.0	G1/4	10	1.050	**P1V-S030A0460**
0.300	2400	1200	2.40	3.60	8.0	G1/4	10	1.050	**P1V-S030A0240**
0.300	1400	700	4.10	6.10	8.0	G1/4	10	1.100	**P1V-S030A0140**
0.300	600	300	9.60	14.30	8.0	G1/4	10	1.150	**P1V-S030A0060**
0.300	280	140	20.50	26.00	8.0	G1/4	10	1.150	**P1V-S030A0028**
0.300	230	115	24.00	36.00	8.0	G1/4	10	3.300	**P1V-S030A0023**
0.130	180	90	13.80	21.00	4.7	G1/4	10	1.150	**P1V-S030A0018**
0.300	100	50	57.00	85.50	8.0	G1/4	10	3.300	**P1V-S030A0010**
0.280	50	25	36.00*	36.00*	8.0	G1/4	10	1.250	**P1V-S030A0005**

* Max. permitted torque



CE Ex II2 GD c IIC T6 (80°C) X

Data For Reversible Air Motor With Threaded Shaft, P1V-S030D Series

Max. Power	Free Speed	Speed At Max. Power	Torque At Max. Power	Min Start Torque	Air Consumption At Max. Power	Connector	Min. Pipe ID	Weight	Order Code
kW	rpm	rpm	Nm	Nm	l/s		mm	kg	
0.300	14500	7250	0.40	0.60	8.,0	G1/4	10	1.000	**P1V-S030D0E50**
0.300	4600	2300	1.20	1.90	8.0	G1/4	10	1.050	**P1V-S030D0460**
0.300	2400	1200	2.40	3.60	8.0	G1/4	10	1.050	**P1V-S030D0240**
0.300	1400	700	4.10	6.10	8.0	G1/4	10	1.100	**P1V-S030D0140**
0.300	600	300	9.60	14.30	8.0	G1/4	10	1.150	**P1V-S030D0060**
0.300	280	140	20.50	26.00	8.0	G1/4	10	1.150	**P1V-S030D0028**
0.130	180	90	13.80	21.00	4.7	G1/4	10	1.150	**P1V-S030D0018**
0.280	50	25	36.00*	36.00*	8.0	G1/4	10	1.250	**P1V-S030D0005**

* Max. permitted torque

NOTE!

The P1V-S030D with threaded shaft may be reversed, but when operated counterclockwise, there is a risk that the driven unit may disconnect if it is not locked properly.

Installation brackets, see page K33
Dimensions, see page K37
Permitted shaft loadings, see page K58
Service kits, see page K60

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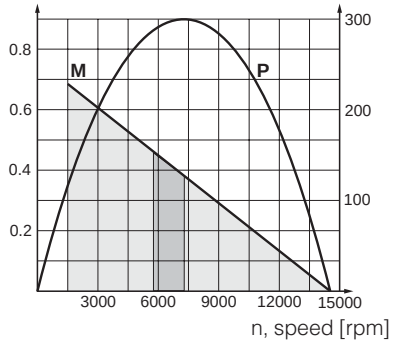
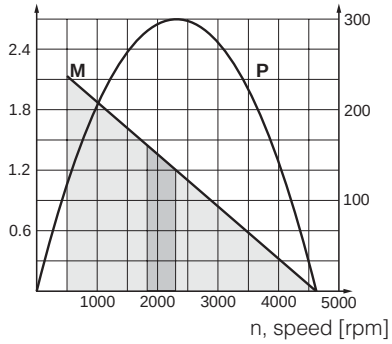
P1V-S030A0E50
P1V-S030D0E50

M, torque [Nm] P, power [W]



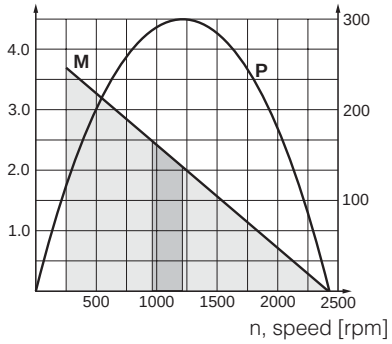
P1V-S030A0460,
P1V-S030D0460

M, torque [Nm] P, power [W]



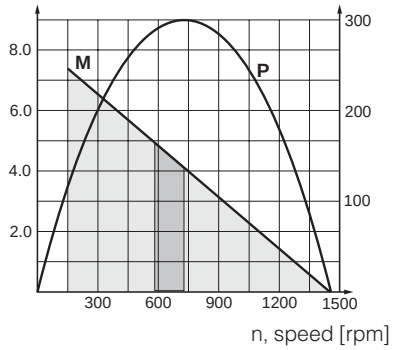
P1V-S030A0240
P1V-S030D0240

M, torque [Nm] P, power [W]



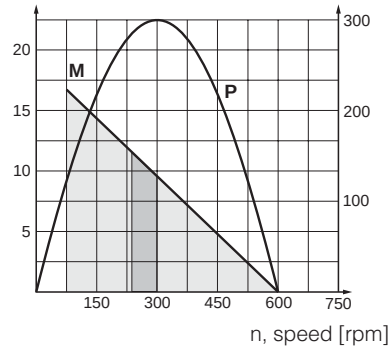
P1V-S030A0140
P1V-S030D0140

M, torque [Nm] P, power [W]



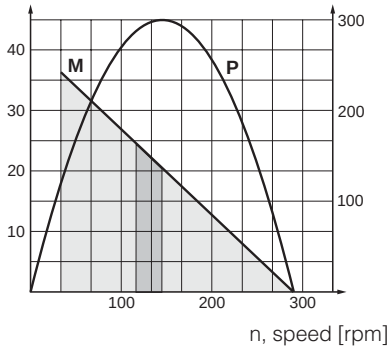
P1V-S030A0060
P1V-S030D0060

M, torque [Nm] P, power [W]



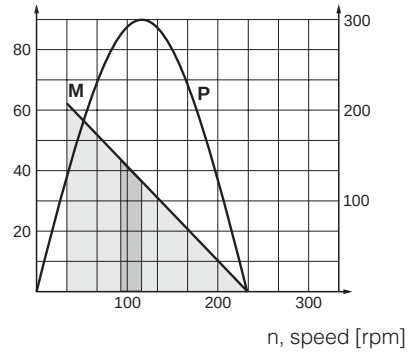
P1V-S030A0028
P1V-S030D0028

M, torque [Nm] P, power [W]



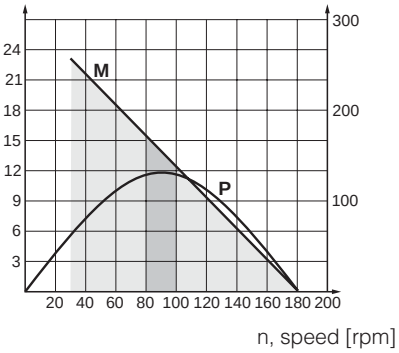
P1V-S030A0023

M, torque [Nm] P, power [W]



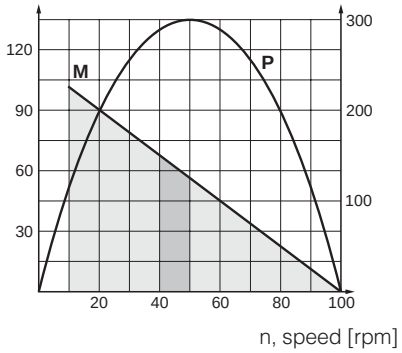
P1V-S030A0018
P1V-S030D0018

M, torque [Nm] P, power [W]



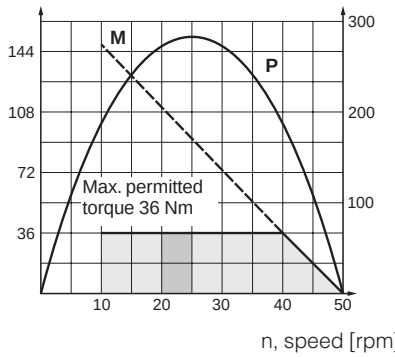
P1V-S030A0010

M, torque [Nm] P, power [W]



P1V-S030A0005
P1V-S030D0005

M, torque [Nm] P, power [W]



Possible working range of motor.

Optimum working range of motor.
Higher speeds = more vane wear
Lower speeds with high torque = more gearbox wear

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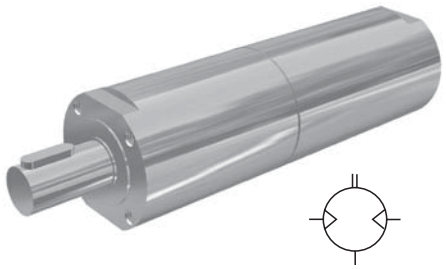
NOTE! All technical data is based on a working pressure of 6 bar.

II2 GD c IIC T6 (80°C) X



Data For Reversible Air Motor With Keyed Shaft, P1V-S060A Series

Max. Power	Free Speed	Speed At Max. Power	Torque At Max. Power	Min Start Torque	Air Consumption At Max. Power	Connector	Min. Pipe ID	Weight	Order Code
kW	rpm	rpm	Nm	Nm	l/s		mm	kg	
0.600	14000	7000	0.82	1.23	14.5	G3/8	12	2.000	**P1V-S060A0E00**
0.600	4000	2000	2.90	4.30	14.5	G3/8	12	2.100	**P1V-S060A0400**
0.600	2700	1350	4.20	6.40	14.5	G3/8	12	2.100	**P1V-S060A0270**
0.600	1700	850	6.70	10.10	14.5	G3/8	12	2.100	**P1V-S060A0170**
0.600	720	360	15.90	24.00	14.5	G3/8	12	2.200	**P1V-S060A0072**
0.600	480	240	23.90	36.00	14.5	G3/8	12	2.200	**P1V-S060A0048**
0.600	300	150	38.20	57.00	14.5	G3/8	12	2.300	**P1V-S060A0030**
0.300	100	50	60.00*	60.00*	13.0	G3/8	12	2.300	**P1V-S060A0010**

* Max. permitted torque

Installation brackets, see page K33
Dimensions, see page K38
Permitted shaft loadings, see page K58
Service kits, see page K60

K

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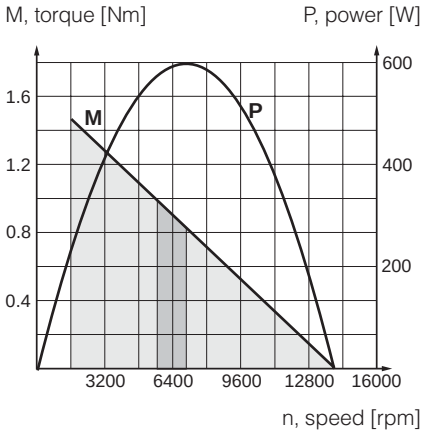
P1V-S060A0E00,



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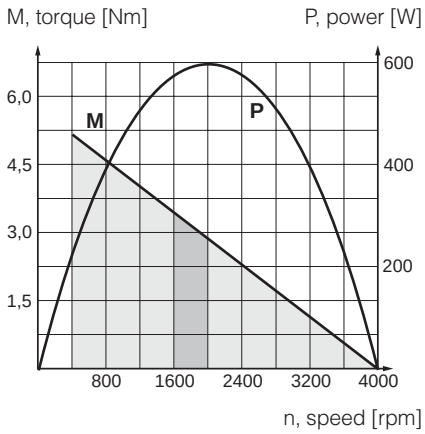

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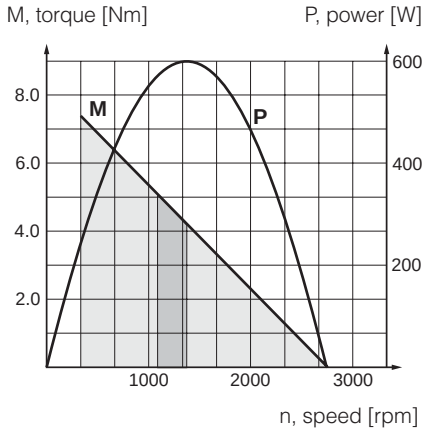

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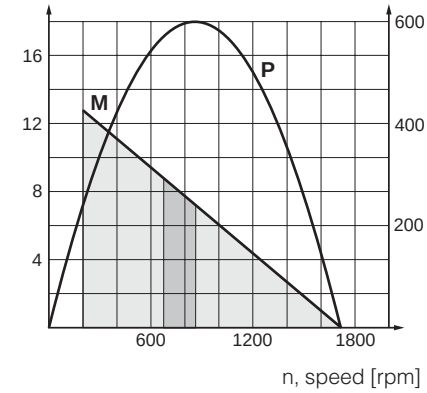
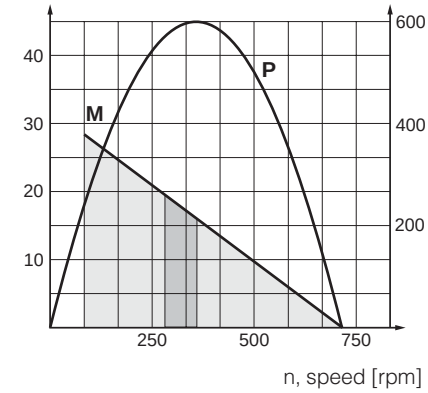
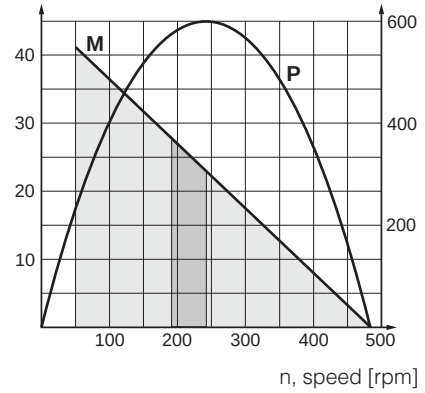


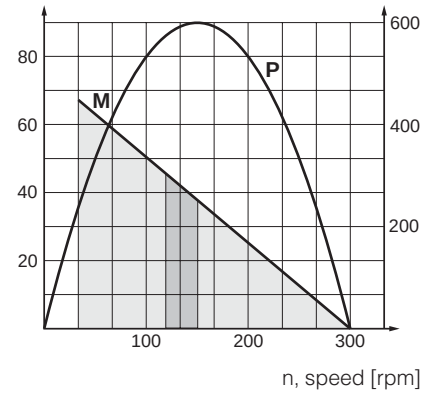
P1V-S060A0072



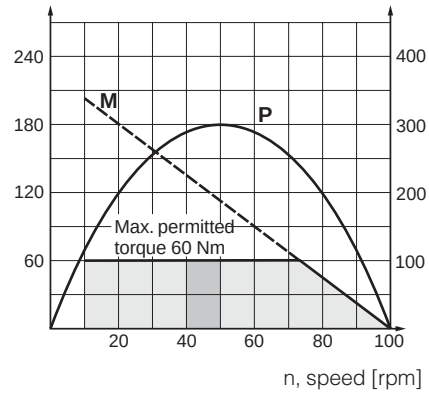
P1V-S060A0048



P1V-S060A0030



P1V-S060A0010



Possible working range of motor.

Optimum working range of motor.
Higher speeds = more vane wear
Lower speeds with high torque = more gearbox wear

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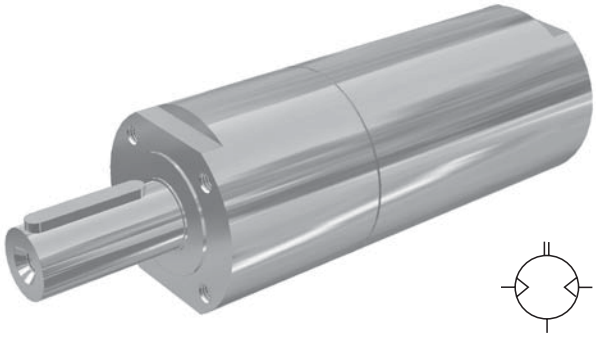
NOTE! All technical data is based on a working pressure of 6 bar.

II2 GD c IIC T5 (95°C) X



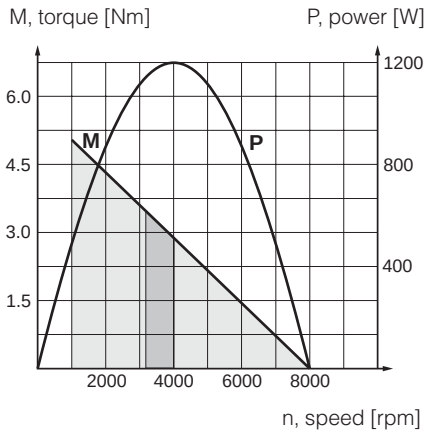
Data For Reversible Air Motor With Keyed Shaft, P1V-S120A Series

Max. Power	Free Speed	Speed At Max. Power	Torque At Max. Power	Min Start Torque	Air Consumption At Max. Power	Connector	Min Pipe ID	Weight	Order Code
kW	rpm	rpm	Nm	Nm	l/s		mm	kg	
1.200	8000	4000	2.90	4.30	27	G3/4	19	5.5	**P1V-S120A0800**
1.200	2700	1350	8.50	12.70	27	G3/4	19	5.5	**P1V-S120A0270**
1.200	1100	550	21.00	31.00	27	G3/4	19	5.5	**P1V-S120A0110**
1.200	780	390	29.40	44.00	27	G3/4	19	5.6	**P1V-S120A0078**
1.200	320	160	71.60	107.00	27	G3/4	19	5.6	**P1V-S120A0032**
0.700	200	100	66.90	110.00*	19	G3/4	19	5.6	**P1V-S120A0012**

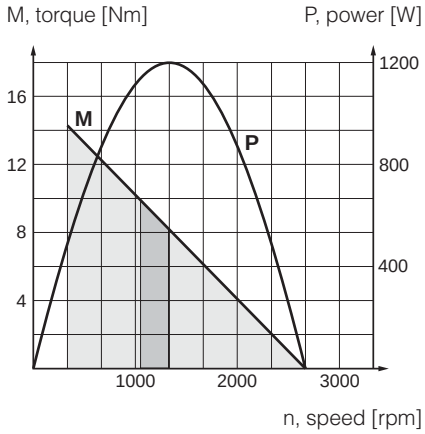
* Max. permitted torque

Installation brackets, see page K33
Dimensions, see page K39
Permitted shaft loadings, see page K58
Service kits, see page K60

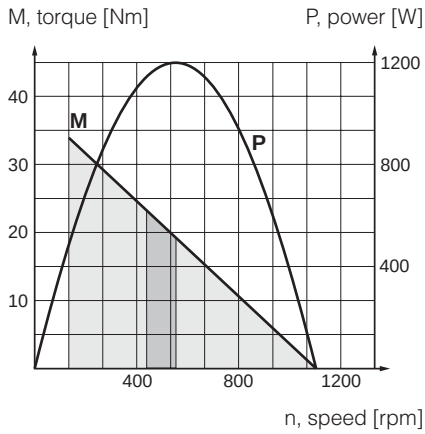
P1V-S120A0800



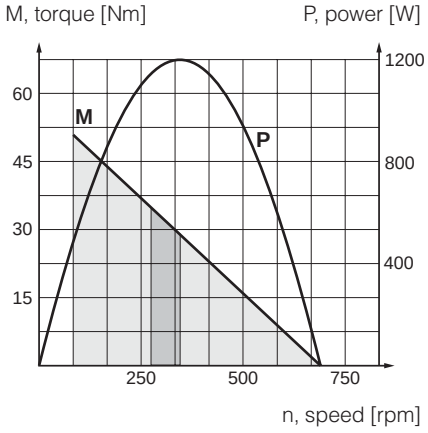
P1V-S120A0270,



P1V-S120A0110



P1V-S120A0078



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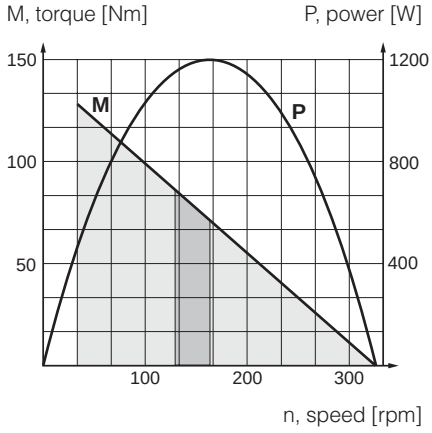
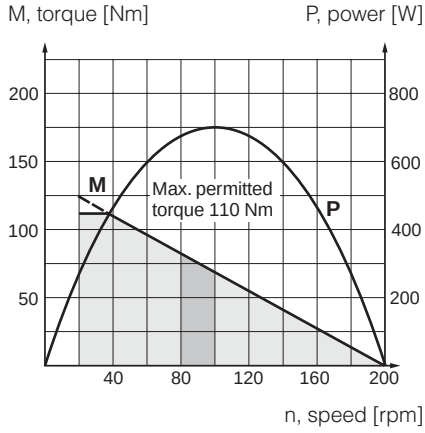


P1V-S120A0012



Possible working range of motor.

Optimum working range of motor.
Higher speeds = more vane wear
Lower speeds with high torque = more gearbox wear

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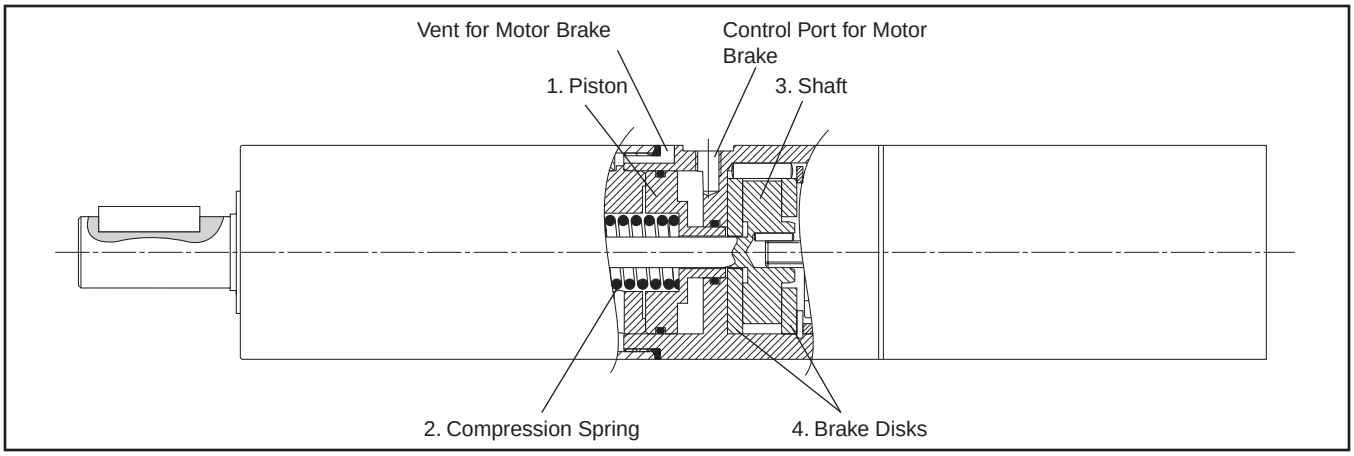
Brake Motor



Brake Motors

Applications

The integrated brake is a spring-loaded disk brake, which is released at a minimum air pressure of 5 bar. The brake is applied in the absence of pressure. As soon as the control port for the brake is placed under pressure, the piston (1) is pressurised and the spring (2) is compressed. The motor can now start and the torque is passed to the shaft (3). The ventilation air from the brake is connected with the atmosphere. In order to brake the motor, the control air to the brake is simply vented. The piston (1) is pushed to the right by the spring (2), and the axle (3) is jammed between the two brake disks (4).

The technology and the size of air motors with integrated running and stationary brake make them ideal applications requiring repeated precise positioning. The motor can also be kept stationary in a specific position, and the stopping time for a rotating weight can be shortened significantly. Another typical application for brake motors is when the output shaft needs to be held in one position when the motor stops delivering torque. The brake can handle more than 1500 braking operations per hour at maximum braking torque.

Disassembly and Reassembly

Detach the connections with the motor and gearbox. Pull off the motor and gearbox part. The brake disks can be lifted off after the lock ring has been removed.

K

Service and Maintenance

After 20 000 braking operations as a stationary brake or 10,000 braking operations as an operating brake, the brake must be disassembled in order to check for wear.

Warning:

If the number of braking operations is exceeded, the degree of wear might be greater than permitted and the braking effect might be lost. If this happens, you simply need to replace the worn brake linings. Tests show that the brake lining needs to be replaced after approx. 90,000 braking cycles.

NOTE!
Brake motors must only ever be supplied with unlubricated air, otherwise there is a risk of oil from the supply air getting into the brake unit, resulting in poor brake performance or no braking effect.

Technical Data

Min braking torque for different motor types

Motor size P1V-S020, 200 Watt

Braking Motor	Motor Max. Torque, Specified Nm	Brake Min Braking Torque, Theoretical Nm	Gearbox Max. Torque, Permitted Nm
P1V-S020A/DDE50	0.52	1.0	1.0
P1V-S020A/DD460	1.6	3.43	3.43
P1V-S020A/DD240	3.2	6.66	6.66
P1V-S020A/DD140	5.4	11.8	11.8
P1V-S020A/DD070	10.8	22.86	14.0
P1V-S020A/DD035	20.0	44.4	20.0
P1V-S020A/DD018	20.0	44.4	20.0
P1V-S020A/D011	66.0	137.2	108.0
P1V-S020A/D006	144.0	266.4	108.0
P1V-S020A/DD005	20.0*	44.4	20.0
P1V-S020A/D002	20.0*	44.4	20.0
P1V-S020A/D001	20.0*	44.4	20.0
P1V-S020A/D0005	20.0*	44.4	20.0

Motor Size P1V-S030, 300 Watt

Braking Motor	Motor Max. Torque, Specified Nm	Brake Min Braking Torque, Theoretical Nm	Gearbox Max. Torque, Permitted Nm
P1V-S030A/DDE50	0.8	1.0	1.0
P1V-S030A/DD460	2.4	3.43	3.43
P1V-S030A/DD240	4.8	6.66	6.66
P1V-S030A/DD140	8.2	11.8	11.8
P1V-S030A/DD060	19.2	20.6	14.0
P1V-S030A/DD028	41.0	40.0	36.0
P1V-S030A/D023	48.0	70.8	108.0
P1V-S030A/D010	114.0	123.6	108.0
P1V-S030A/DD005	36.0*	40.0	36.0

*** Warning:**
The permitted torque for the specific gearbox must not be exceeded!

Brake Release

Minimum pressure for brake release: 5 bar

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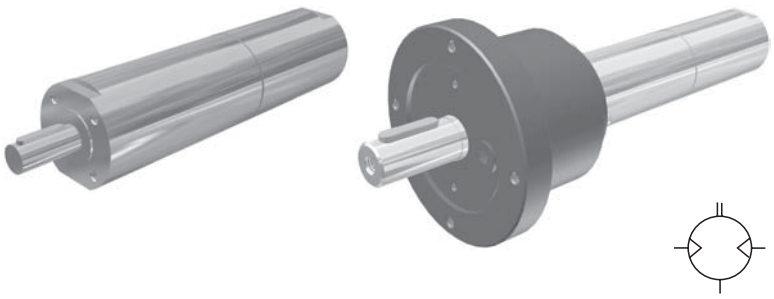
NOTE! All technical data is based on a working pressure of 6 bar.



Data For Reversible Brake Motor With Keyed Shaft, P1V-S020AD Series

Max. Power	Free Speed	Speed At Max. Power	Torque At Max. Power	Min Start Torque	Air Consumption At Max. Power	Connector	Min Pipe ID	Weight	Order Code
kW	rpm	rpm	Nm	Nm	l/s		mm	kg	
0.200	14500	7250	0.26	0.40	6.3	G1/8	10	1.000	**P1V-S020ADE50**
0.200	4600	2300	0.80	1.20	6.3	G1/8	10	1.050	**P1V-S020AD460**
0.200	2400	1200	1.60	2.40	6.3	G1/8	10	1.050	**P1V-S020AD240**
0.200	1400	700	2.70	4.10	6.3	G1/8	10	1.150	**P1V-S020AD140**
0.200	700	350	5.40	8.20	6.3	G1/8	10	1.150	**P1V-S020AD070**
0.200	350	160	12.00	18.00	6.3	G1/8	10	1.150	**P1V-S020AD035**
0.100	180	90	10.50	15.00	4.5	G1/8	10	1.150	**P1V-S020AD018**
0.200	110	55	33.00	49.50	6.3	G1/8	10	3.300	**P1V-S020AD011**
0.200	60	30	72.00	108.00*	6.3	G1/8	10	3.300	**P1V-S020AD006**
0.180	50	25	20.00*	20.00*	6.3	G1/8	10	1.250	**P1V-S020AD005**
0.180	20	–	20.00*	20.00*	6.3	G1/8	10	1.250	**P1V-S020AD002**
0.180	10	–	20.00*	20.00*	6.3	G1/8	10	1.350	**P1V-S020AD001**
0.180	5	–	20.00*	20.00*	6.3	G1/8	10	1.350	**P1V-S020AD0005**

* Max. permitted torque

Torque curves, see page K22
Installation brackets, see page K33
Dimensions, see page K40
Permitted shaft loadings, see page K58
Service kits, see page K60

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Wadsworth, Ohio
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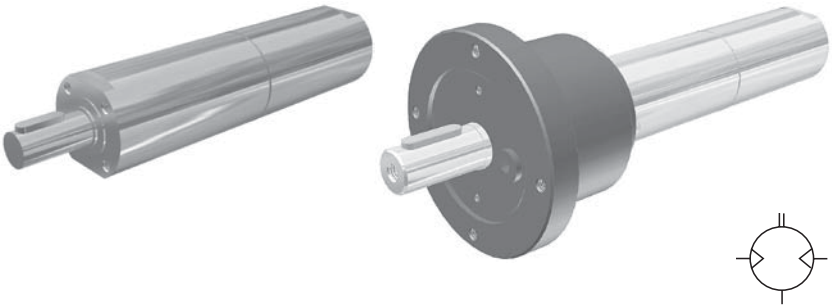
NOTE! All technical data is based on a working pressure of 6 bar.



Data For Reversible Brake Motor With Keyed Shaft, P1V-S030AD Series

Max. Power	Free Speed	Speed At Max. Power	Torque At Max. Power	Min Start Torque	Air Consumption At Max. Power	Connector	Min Pipe ID	Weight	Order Code
kW	rpm	rpm	Nm	Nm	l/s		mm	kg	
0.300	14500	7250	0.40	0.60	8,0	G1/4	10	1.350	**P1V-S030ADE50**
0.300	4600	2300	1.20	1.90	8,0	G1/4	10	1.400	**P1V-S030AD460**
0.300	2400	1200	2.40	3.60	8,0	G1/4	10	1.400	**P1V-S030AD240**
0.300	1400	700	4.10	6.10	8,0	G1/4	10	1.450	**P1V-S030AD140**
0.300	600	300	9.60	14.30	8,0	G1/4	10	1.500	**P1V-S030AD060**
0.300	280	140	20.50	26.00	8,0	G1/4	10	1.500	**P1V-S030AD028**
0.300	230	115	24.00	36.00	8,0	G1/4	10	3.650	**P1V-S030AD023**
0.300	100	50	57.00	85.50	8,0	G1/4	10	3.650	**P1V-S030AD010**
0.280	50	25	36.00*	36.00*	8,0	G1/4	10	1.600	**P1V-S030AD005**

* Max. permitted torque

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Torque curves, see page K24
Installation brackets, see page K33
Dimensions, see page K40
Permitted shaft loadings, see page K58
Service kits, see page K60

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Order Key

P 1 V - S **4** **0 1 2** **B**

	Air Motor Range
P1V-S	Stainless

	Accessories
4	Bracket

	Motor Size
002	20 W
008	80 W
012	120 W
020	200 W
030	300 W
060	600 W
120	1200 W

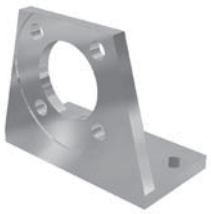
	Bracket
B	Flange Bracket
F	Foot Bracket
C	Foot Bracket, Large

Installation Brackets for P1V-S

Flange Bracket

For Air Motor	For Drilling Motor	Weight Kg	Order Code
P1V-S002		0.04	**P1V-S4002B**
P1V-S008	P1V-S008	0.04	**P1V-S4008B**
P1V-S012		0.05	**P1V-S4012B**
P1V-S020	P1V-S025	0.09	**P1V-S4020B**
P1V-S030	P1V-S040	0.12	**P1V-S4030B**
P1V-S060		0.25	**P1V-S4060B**
P1V-S120		0.60	**P1V-S4120B**

Foot Bracket



For Air Motor	For Drilling Motor	Weight Kg	Order Code
P1V-S008	P1V-S008	0.08	**P1V-S4008F**
P1V-S012		0.09	**P1V-S4012F**
P1V-S020	P1V-S025	0.11	**P1V-S4020F**
P1V-S020A0011 P1V-S020A0006 P1V-S030A0023 P1V-S030A0010		0.55	**P1V-S4020C**
P1V-S030	P1V-S040	0.11	**P1V-S4030F**
P1V-S060		0.30	**P1V-S4060F**
P1V-S120		0.80	**P1V-S4120F**

All brackets supplied with fastening screws for the motor.

Dimensions, see pages K34 to K39

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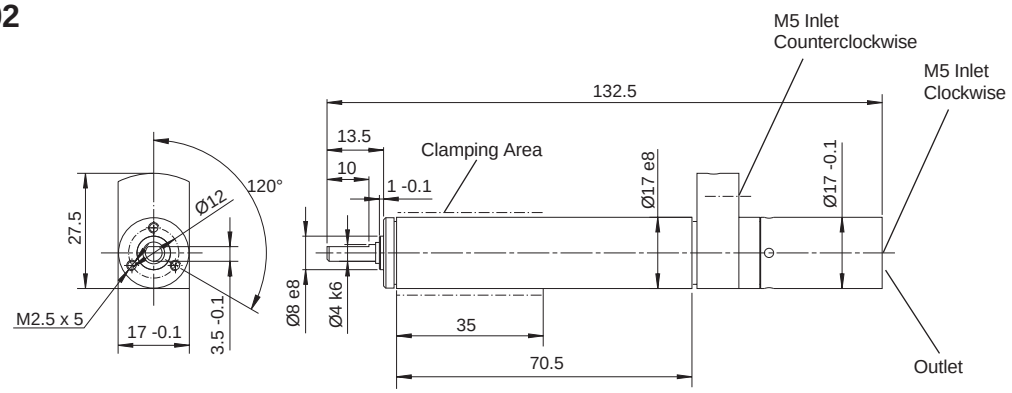
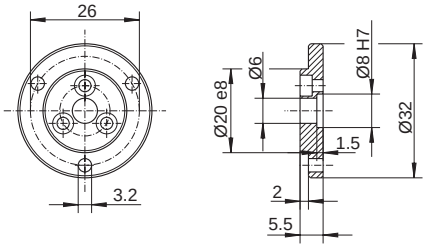
Motor P1V-S002



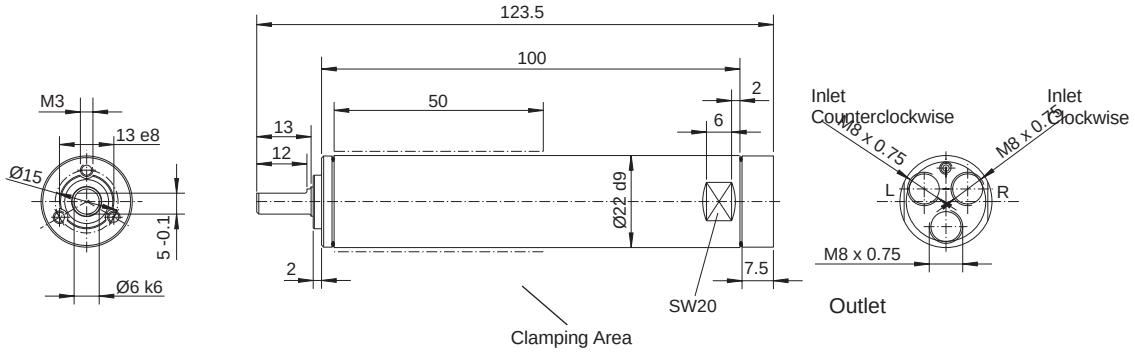
Flange Bracket for Motor P1V-S002

P1V-S4002B



Dimensions

Motor P1V-S008



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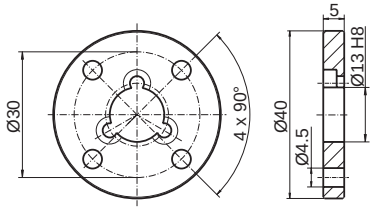
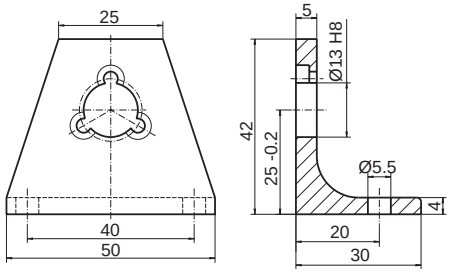
Flange Bracket for Motor P1V-S008

P1V-S4008B



Foot Bracket for Motor P1V-S008

P1V-S4008F



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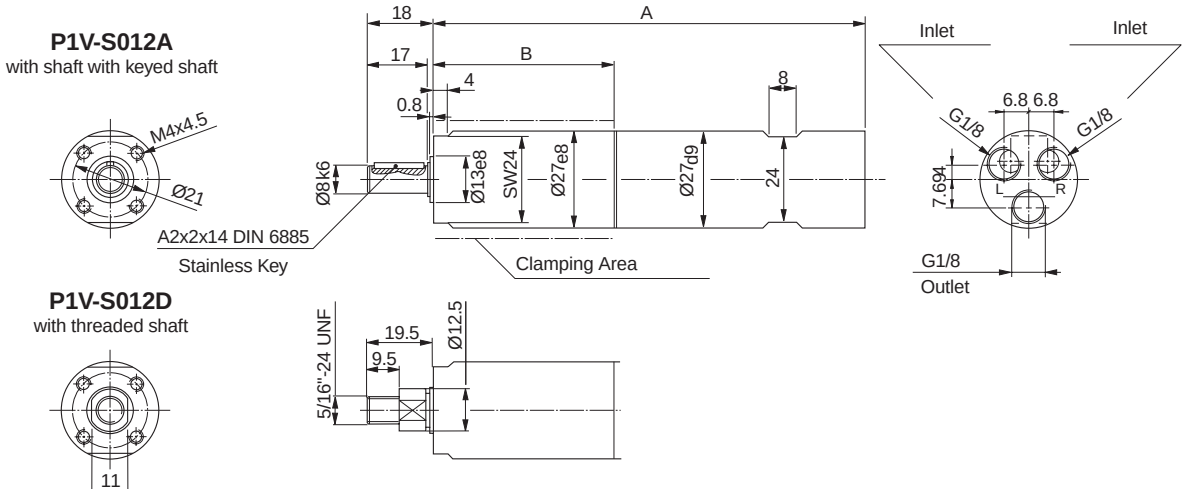
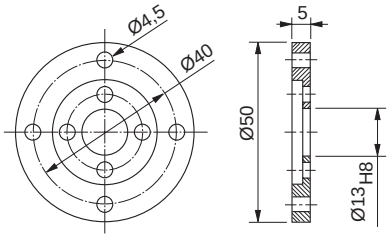
Motor P1V-S012



	A	B
P1V-S012A0N00, P1V-S012D0N00	117.0	46.5
P1V-S012A0550, P1V-S012D0550	117.0	46.5
P1V-S012A0360, P1V-S012D0360	117.0	46.5
P1V-S012A0140, P1V-S012D0140	129.5	59.0
P1V-S012A0090, P1V-S012D0090	129.5	59.0
P1V-S012A0060, P1V-S012D0060	129.5	59.0
P1V-S012A0010, P1V-S012D0010	142.0	71.5

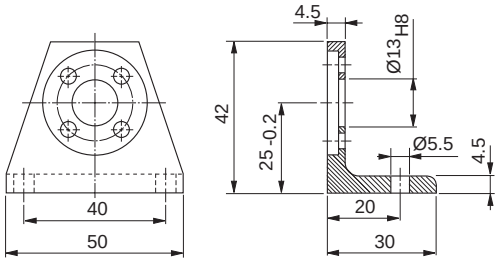
Flange Bracket for Motor P1V-S012

P1V-S4012B



Foot Bracket for Motor P1V-S012

P1V-S4012F



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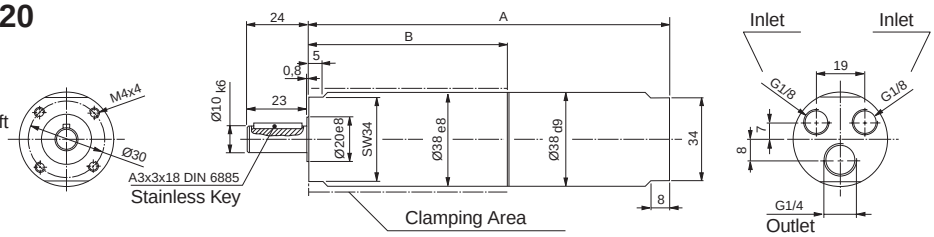
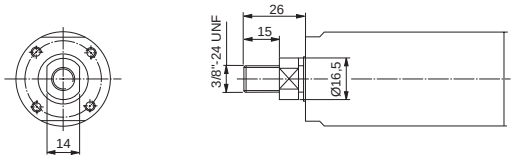
Motor P1V-S020

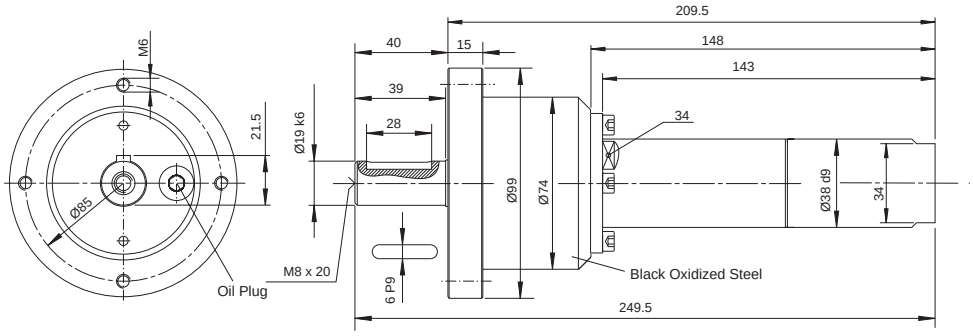
P1V-S020A
with shaft with keyed shaft



P1V-S020D
with threaded shaft



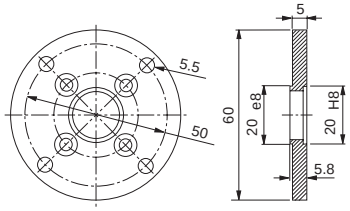
P1V-S020A0011
P1V-S020A0006



	A	B
P1V-S020A0E50, P1V-S020D0E50	127	63.5
P1V-S020A0460, P1V-S020D0460	127	63.5
P1V-S020A0240, P1V-S020D0240	127	63.5
P1V-S020A0140, P1V-S020D0140	143	79.5
P1V-S020A0070, P1V-S020D0070	143	79.5
P1V-S020A0035, P1V-S020D0035	143	79.5
P1V-S020A0018, P1V-S020D0018	143	79.5
P1V-S020A0005, P1V-S020D0005	159	95.5
P1V-S020A0002	159	95.5
P1V-S020A0001	175	111.5
P1V-S020A00005	175	111.5

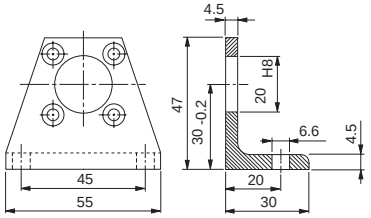
Flange Bracket for Motor P1V-S020

P1V-S4020B



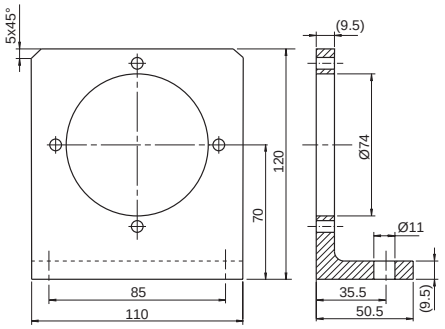
Foot Bracket for Motor P1V-S020

P1V-S4020F



Foot Bracket for Motor P1V-S020A0011 and P1V-S020A0006

P1V-S4020C



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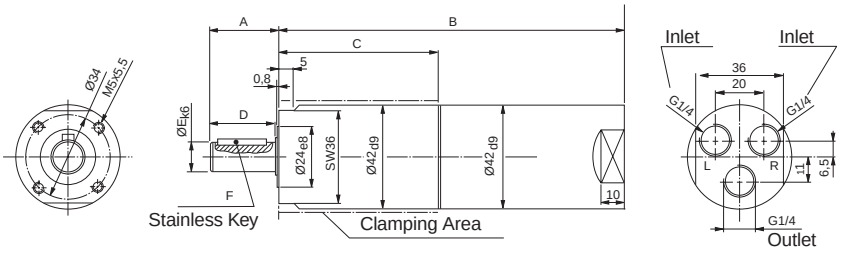
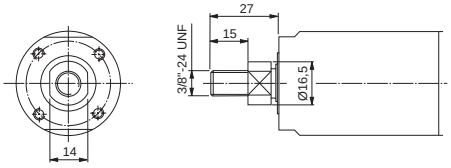
Motor P1V-S030

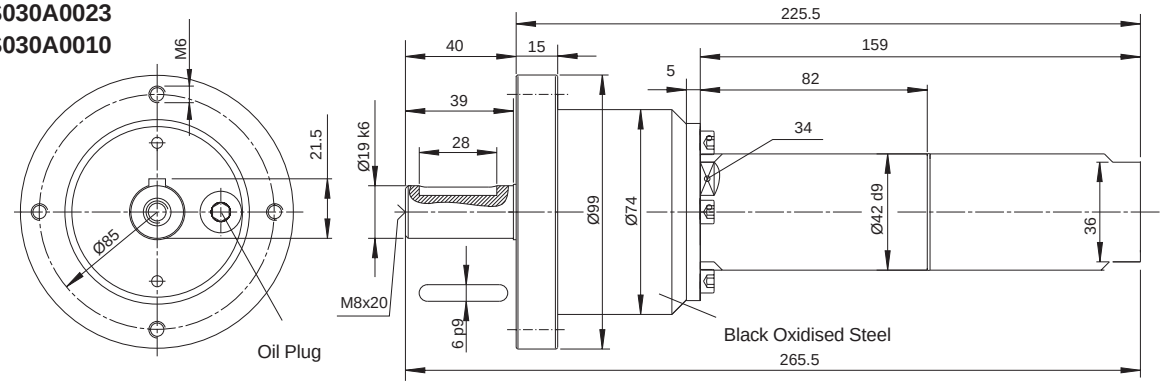
P1V-S030A
with shaft with keyed shaft



P1V-S030D
with threaded shaft



P1V-S030A0023
P1V-S030A0010



	A	B	C	D	E	F
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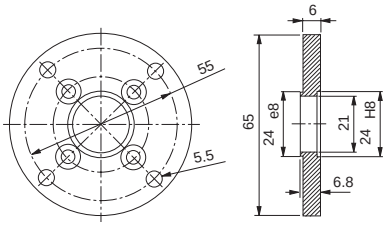
P1V-S030A0460, P1V-S030D0460	28.5	143	66	27	12	A4x4x20 DIN 6885
P1V-S030A0240, P1V-S030D0240	28.5	143	66	27	12	A4x4x20 DIN 6885
P1V-S030A0140, P1V-S030D0140	28.5	159	82	27	12	A4x4x20 DIN 6885
P1V-S030A0060, P1V-S030D0060	32.0	159	82	30	14	A5x5x20 DIN 6885
P1V-S030A0028, P1V-S030D0028	32.0	159	82	30	14	A5x5x20 DIN 6885
P1V-S030A0018, P1V-S030D0018	32.0	159	82	30	14	A5x5x20 DIN 6885
P1V-S030A0005, P1V-S030D0005	32.0	164	82	30	14	A5x5x20 DIN 6885

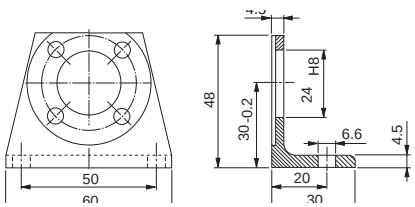
Flange Bracket for Motor P1V-S030

P1V-S4030B



Foot Bracket for Motor P1V-S030

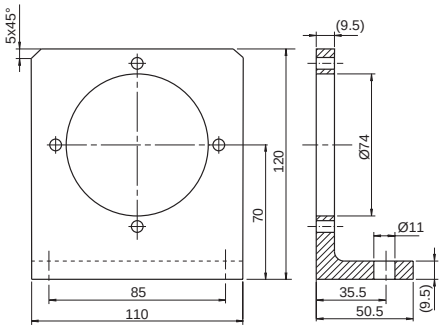
P1V-S4030F



Foot Bracket for Motor

P1V-S030A0023 and P1V-S030A0010

P1V-S4020C



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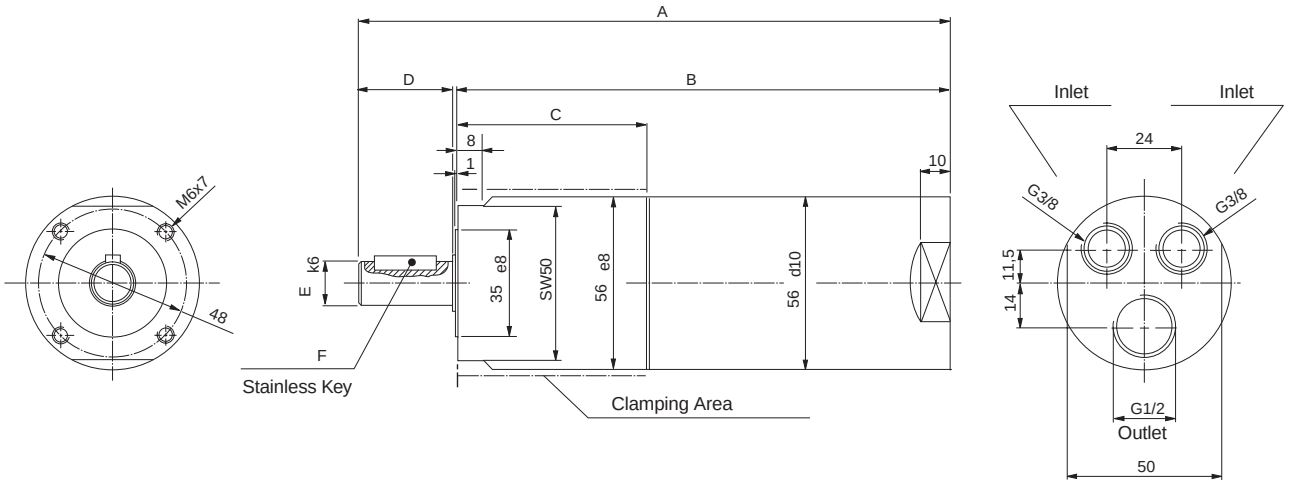
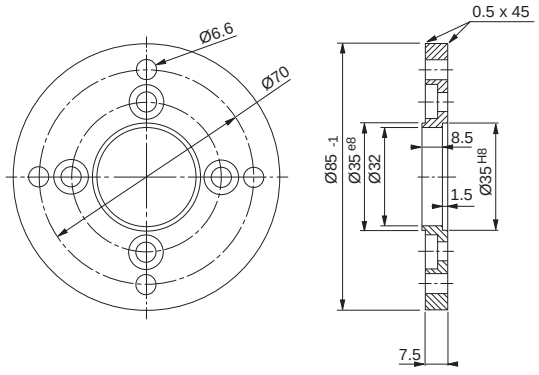
Motor P1V-S060



	A	B	C	D	E	F
P1V-S060A0E00	194	162	62,4	30	14	A5x5x20 DIN 6885
P1V-S060A0400	194	162	62,4	30	14	A5x5x20 DIN 6885
P1V-S060A0270	194	162	62,4	30	14	A5x5x20 DIN 6885
P1V-S060A0170	194	162	62,4	30	14	A5x5x20 DIN 6885
P1V-S060A0072	212	180	62,4	30	14	A5x5x20 DIN 6885
P1V-S060A0048	212	180	80,4	30	19	A6x6x22 DIN 6885
P1V-S060A0030	217	180	80,4	35	19	A6x6x22 DIN 6885
P1V-S060A0010	217	180	80,4	35	19	A6x6x22 DIN 6885

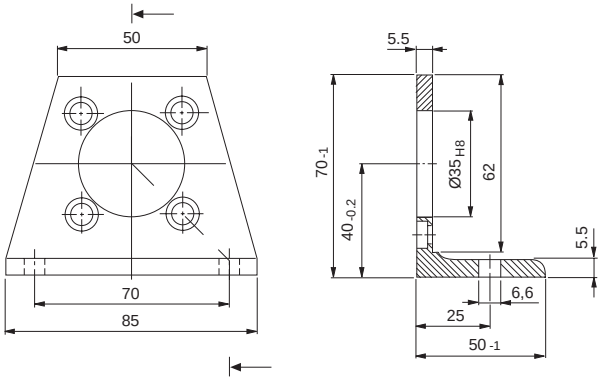
Flange Bracket for Motor P1V-S060

P1V-S4060B



Foot Bracket for Motor P1V-S060

P1V-S4060F



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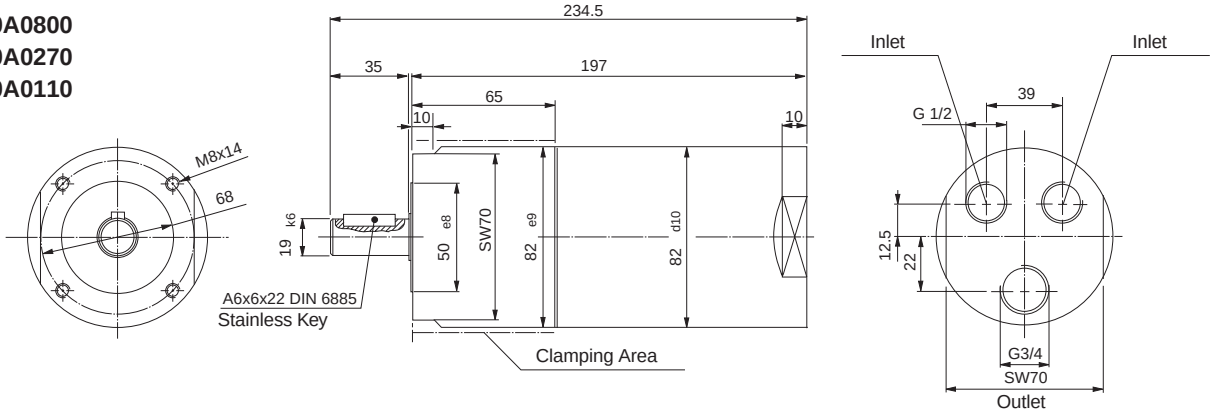
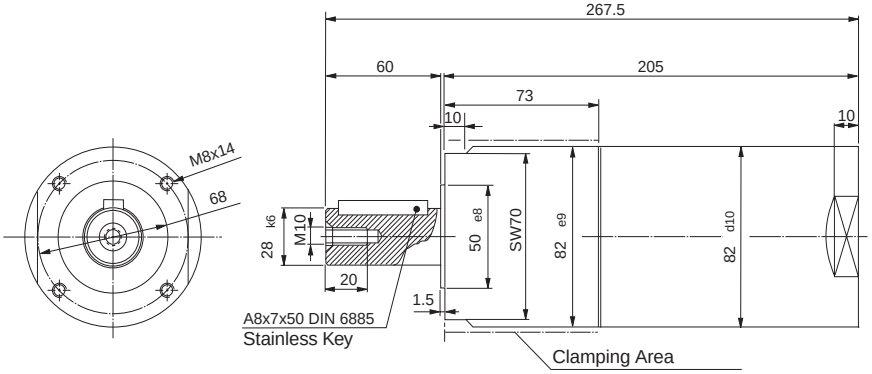
Motor P1V-S120

P1V-S120A0800
P1V-S120A0270
P1V-S120A0110

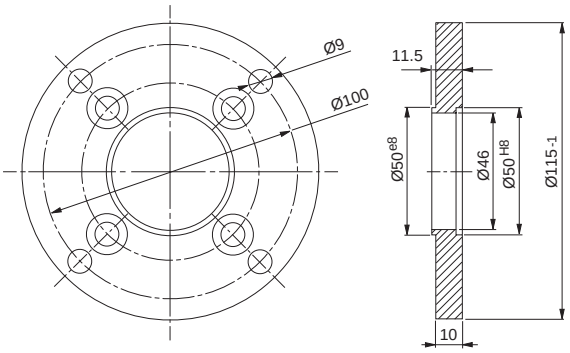


P1V-S120A0078
P1V-S120A0032
P1V-S120A0012



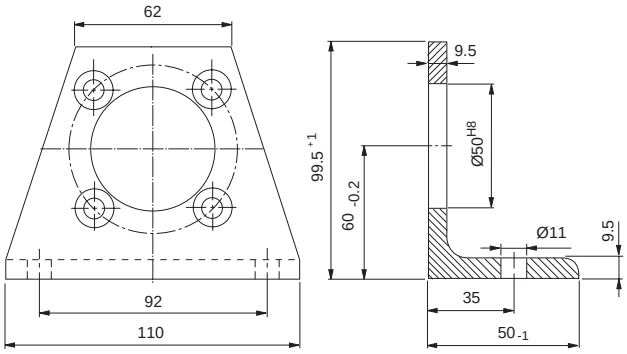
Flange Bracket for Motor P1V-S120

P1V-S4120B



Foot Bracket for Motor P1V-S120

P1V-S4120F



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AirCad™ Drawing Library

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Air Motors

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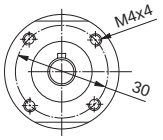
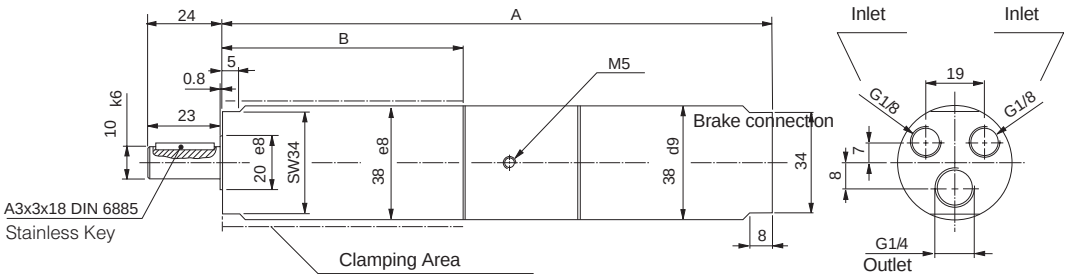
Brake Motor P1V-S020

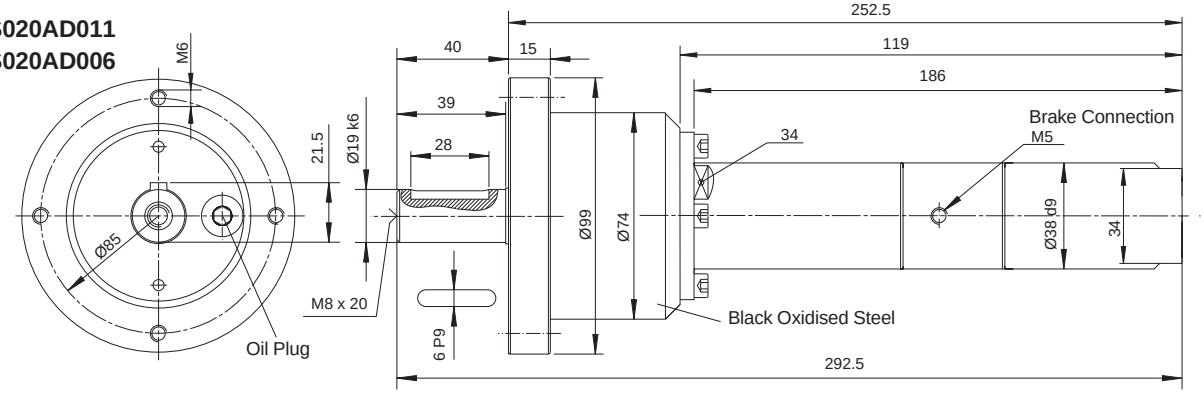
P1V-S020AD
with shaft with keyed shaft





P1V-S020DD
with threaded shaft

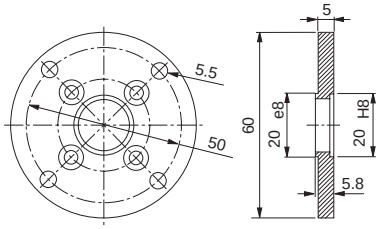
P1V-S020AD011
P1V-S020AD006



	A	B
P1V-S020ADE50	170	63.5
P1V-S020AD460	170	63.5
P1V-S020AD240	170	63.5
P1V-S020AD140	186	79.5
P1V-S020AD070	186	79.5
P1V-S020AD035	186	79.5
P1V-S020AD018	186	79.5
P1V-S020AD005	202	95.5
P1V-S020AD002	202	95.5
P1V-S020AD001	218	111.5
P1V-S020AD0005	218	111.5

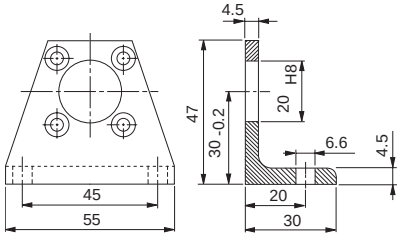
Flange Bracket for Motor P1V-S020

P1V-S4020B



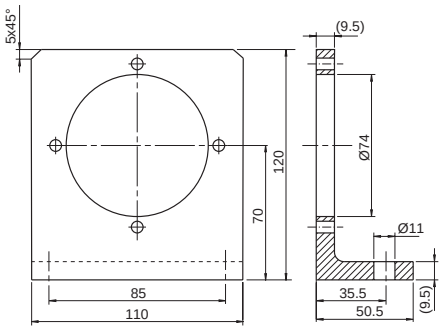
Foot Bracket for Motor P1V-S020

P1V-S4020F



Foot Bracket for Motor P1V-S020AD0011 and P1V-S020AD0006

P1V-S4020C



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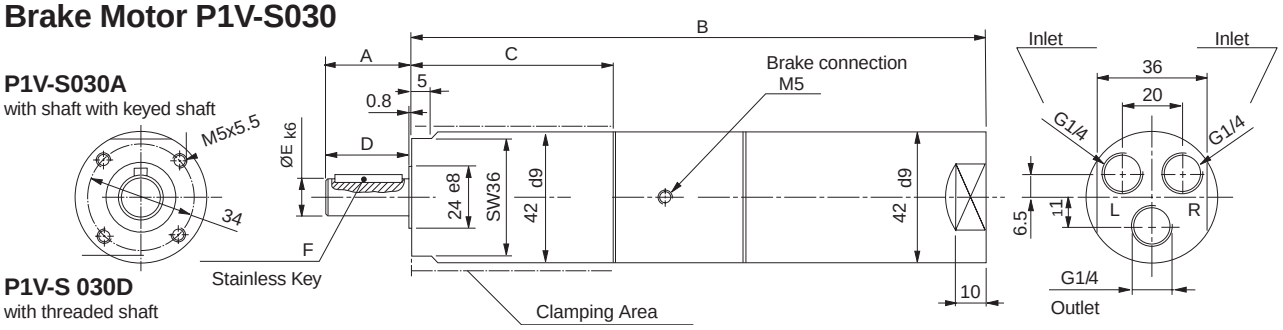
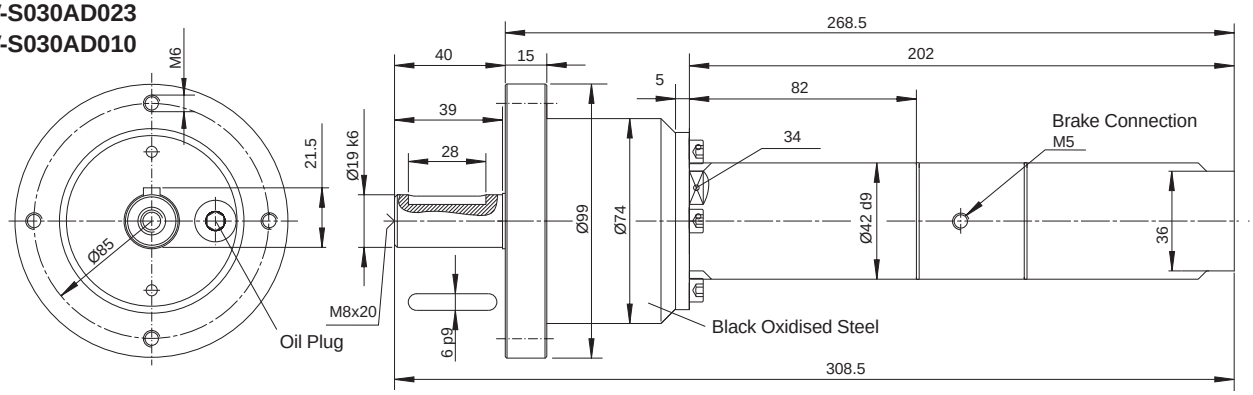
Brake Motor P1V-S030

P1V-S030A
with shaft with keyed shaft

P1V-S 030D
with threaded shaft



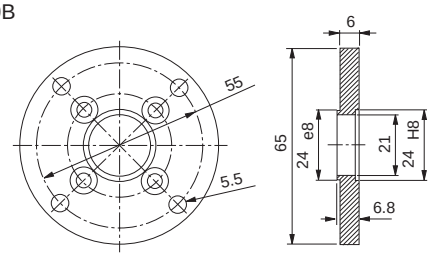
P1V-S030AD023
P1V-S030AD010



	A	B	C	D	E	F
P1V-S030ADE50	28.5	186	66	27	12	A4x4x20 DIN 6885
P1V-S030AD460	28.5	186	66	27	12	A4x4x20 DIN 6885
P1V-S030AD240	28.5	186	66	27	12	A4x4x20 DIN 6885
P1V-S030AD140	28.5	202	82	27	12	A4x4x20 DIN 6885
P1V-S030AD060	32.0	202	82	30	14	A5x5x20 DIN 6885
P1V-S030AD028	32.0	202	82	30	14	A5x5x20 DIN 6885

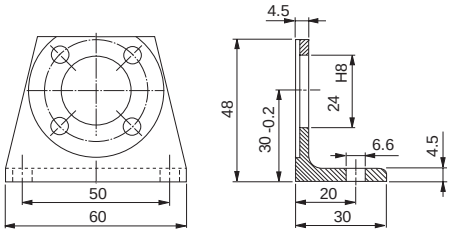
Flange Bracket for Motor P1V-S030

P1V-S4030B



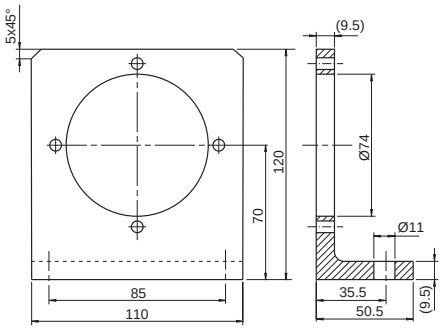
Foot bracket for motor P1V-S030

P1V-S4030F



Foot Bracket for Motor P1V-S030AD0023 and P1V-S030AD0010

P1V-S4020C



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AirCad™ Drawing Library

K
Air Motors

Parker Hannifin Corporation
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Features

A large number of drilling motors, milling motors and grinding motors have been developed using the P1V-S as the base motor in order to make it easier to install air motors in machining applications. These motors are all equipped with standard vanes for intermittent lubrication-free operation, although it is recommended to use oil mist if you are planning to operate them for extended periods.

NOTE! These motors are not made of 100% stainless steel.

Drilling motors are available with power ratings of 80, 170, 250 and 400 Watts, and several different speeds for the machining of a range of materials. They can be fitted with collet chucks, drill chucks and quick-release chucks. Many of them also have accessories allowing the exhaust air to be removed.

The milling motor, with a power rating of 400 Watts, runs at a relatively high speed, and is fitted with a collet chuck for a shaft diameter of 8 mm. It is equipped with strong bearings able to handle greater shear forces on the spindle.

The grinding motor, with a power rating of 200 Watts, is fitted with a collet chuck for a shaft diameter of 8 mm and runs at a relatively high speed. It is equipped with strong bearings able to handle greater shear forces on the spindle.

The design principle of the 90 Watt grinding motor is different from the others. The turbine principle means that high speeds are possible without the need for lubrication.

Feed Movement in Drilling, Milling and Grinding Motors

A slow and even feed movement is necessary in machining applications. During drilling, the feed must not uncontrollably speed up once the drill breaks through the material. One good way of solving the problem is to use a pneumatic cylinder for the feed, which is able to provide force during drilling and a rapid approach before the actual drilling phase. Feed during the drilling phase is controlled using a hydraulic brake cylinder (HYDROCHECK) fitted in parallel with the pneumatic cylinder. This provides even, slow and safe feed movement, without the risk of the uncontrolled feed described above.

Technical Data:

Working pressure:	Max. 7 bar
Working temperature:	-30 °C to +100 °C
Medium:	40 µm filtered oil mist (unlubricated for grinding motor P1V-S009)
Other technical data	
See table for each motor	

Material Specification

Drilling Motors P1V-S008N, P1V-S025N/M, P1V-S040M, Milling Motor P1V-S040N and Grinding Motor P1V-S020N

Housing	Stainless steel, X12Cr13
Shaft, collet chuck	Hardened steel (not stainless)
Shaft for drill chuck	Hardened and tempered steel (not stainless)

Drilling Motors P1V-S017N/M and Grinding Motor P1V-S009N

Housing	High grade steel (not stainless)
Shaft, collet chuck	Hardened steel (not stainless)
Shaft for drill chuck	Hardened and tempered steel (not stainless)
All	
Internal parts	High grade steel (not stainless)
Accessories	Surface treated steel, plastic aluminium

Order Key

P 1 V - S 0 1 7 N 0 Q 0 0

	Motor Size
008	80 W
009	90 W
017	170 W
025	250 W
030	300 W
040	400 W

	Function
M	B10 / B12 Shaft
N	Collet Chuck

	Free Speed per min
035 … **999**	350 … 9990
A00	10000
H00	17000
L00	20000
Q00	24000
X00	30000
A000	100000

	Air Motor Range
P1V-S	Drilling, Milling and gGrinding Motors

Possible Combinations
Please refer to pages K43 to K50.

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Standard Speeds for HSS Spiral Drills

Average Speed Material	Drilling Ømm									
	1	2	3	4	5	6	7	8	9	10
35 m/min Unalloyed Steel up to 500 N/mm²	11000	5500	3700	2800	2200	1900	1600	1400	1200	1100
28 m/min Unalloyed Steel from 500 to 700 N/mm²	8800	4400	3000	2200	1800	1500	1300	1100	975	880
25 m/min Unalloyed Steel over 700 N/mm²	7800	3900	2600	2000	1600	1300	1100	975	865	780
14 m/min Alloyed Steel from 700 to 900 N/mm²	4400	2200	1500	1100	880	735	630	550	490	440
11 m/min Alloyed Steel from 900 to 1100 N/mm²	3400	1700	1100	850	680	570	485	425	380	340
7 m/min Stainless Steel	2200	1100	730	550	440	365	315	275	245	220
22 m/min Cast Iron up to 180 N/mm²	7000	3500	2300	1700	1400	1200	1000	875	780	700
12 m/min Cast Iron over 180 N/mm²	3800	1900	1300	950	760	630	540	475	420	380
50 m/min Copper, Red Metal, Bronze, Brass	16000	8000	5300	4000	3200	2700	2300	2000	1800	1600
90 m/min Rough Light-alloy Metal, Screw Brass[2]	28000	14000	9000	7000	5600	4800	4000	3500	3100	2800
165 m/min Hardened Light-alloy Meta	52000	26000	17300	13000	10400	8700	7400	6500	5800	5200
210 m/min Magnesium Alloy[1]	66000	33000	22000	16500	13200	11000	9400	8300	7400	6600

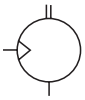
1 Speeds for processing two-component plastics, cardboard or plastic-coated fabrics plaster, HSS drills must not be used - use a high-speed steel drill fitted with a hard metal K10 instead

2 Double the values for thermoplastics

Drilling Motor P1V-S008N

Our smallest and most versatile drilling motor for small-scale drilling operations.

The standard collet chuck is for 3 mm shaft diameter.
For other diameters, select a different collet chuck as an accessory.
The motor has a port for a 6 mm hose to remove the exhaust air to a silencer.



Data for Drilling Motor P1V-S008N

Max. Power	Free Speed	Version	Drilling in Steel	Drilling in Aluminium	Air Consumption at Max.. Power	Conn.	Min Pipe ID	Weight	Order Code
kW	rpm	mm	mm	l/s			mm	Kg	
0.080	24000	Collet Chuck 3 mm	—	3	3.8	M8 x 0.75*	4	0.20	**P1V-S008N0Q00**
0.080	7000	Collet Chuck 3 mm	3	3	3.8	M8 x 0.75*	4	0.20	**P1V-S008N0700**
0.080	1900	Collet Chuck 3 mm	3	3	3.8	M8 x 0.75*	4	0.22	**P1V-S008N0190**
0.080	1300	Collet Chuck 3 mm	3	3	3.8	M8 x 0.75*	4	0.22	**P1V-S008N0130**

* 2 push in nipples (F28PMB6M8SP) for plastic pipe Ø6/4 supplied

Accessories for Drilling Motor P1V-S008N

Collet Chucks	Order Code
Collet Chuck Ø2 mm	**P1V-6/314693**
Collet Chuck Ø3 mm	**Standard**
Collet Chuck Ø3/32"	**P1V-6/314694**
Collet Chuck Ø1/8"	**P1V-6/314407**

NOTE! All technical data is based on a working pressure of 6 bar.

Installation brackets, see page K33
Dimensions, see page K51
Permitted shaft loadings, see page K59
Service kits, see page K62

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Drilling Motor P1V-S017N

A small drilling motor for small-scale, lighter drilling operations.

The standard collet chuck is for 6 mm shaft diameter.
For other diameters, select a different collet chuck as an accessory.

The motor has a built-in silencer for exhaust air. If lower noise levels are required,
or if you want the exhaust air to be collected, the relevant accessories are available.

Data for Drilling Motor P1V-S017N

Max. Power	Free Speed	Version	Drilling in Steel	Drilling in Aluminium	Air Consumption at Max.. Power	Conn.	Min Pipe ID	Weight	Order Code
kW	rpm	mm	mm	l/s			mm	Kg	
0.170	24000	Collet Chuck 6 mm	—	4	5.0	G1/4o	6	0.38	**P1V-S017N0Q00**
0.170	6000	Collet Chuck 6 mm	3	5	5.0	G1/4o	6	0.38	**P1V-S017N0600**
0.170	4000	Collet Chuck 6 mm	4	6	5.0	G1/4o	6	0.38	**P1V-S017N0400**
0.170	1500	Collet Chuck 6 mm	4	6	5.0	G1/4o	6	0.38	**P1V-S017N0150**
0.170	1000	Collet Chuck 6 mm	4	6	5.0	G1/4o	6	0.38	**P1V-S017N0100**
0.170	660	Collet Chuck 6 mm	4	6	5.0	G1/4o	6	0.38	**P1V-S017N0066**

Accessories for Drilling Motor P1V-S017N

Collet Chucks	Order Code
Collet Chuck Ø3 mm	**P1V-6/312681**
Collet Chuck Ø4 mm	**P1V-6/312684**
Collet Chuck Ø5 mm	**P1V-6/312686**
Collet Chuck Ø6 mm	**Standard**
Collet Chuck Ø1/8"	**P1V-6/312682**
Collet chuck Ø1/4"	**P1V-6/312689**
Other Accessories	
Outlet Hose	**P1V-6/806112**
Seal for Outlet Hose	**P1V-6/823221**
Outlet Connection Parallel	**P1V-6/302923A**

NOTE! All technical data is based on a working pressure of 6 bar.

Dimensions, see page K51
Permitted shaft loadings, see page K59
Service kits, see page K62

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Drilling Motor P1V-S017M

A small drilling motor for small-scale, lighter drilling operations.

Select drill chucks as accessories.

The motor has a built-in silencer for exhaust air. If lower noise levels are required,
or if you want the exhaust air to be collected, the relevant accessories are available.

Data for Drilling Motor P1V-S017N

Max. Power	Free Speed	Version	Drilling in Steel	Drilling in Aluminium	Air Consumption at Max. power	Conn.	Min Pipe ID	Weight	Order Code
kW	rpm	mm	mm	l/s			mm	Kg	
0.170	6000	For Drill Chuck B10	3	5	5.0	G1/4o	6	0.38	**P1V-S017M0600**
0.170	4000	For Drill Chuck B10	4	6	5.0	G1/4o	6	0.38	**P1V-S017M0400**
0.170	1500	For Drill Chuck B10	4	6	5.0	G1/4o	6	0.38	**P1V-S017M0150**
0.170	1500	For Drill Chuck B10	4	6	5.0	G1/4o	6	0.38	**P1V-S017M0100**
0.170	660	For Drill Chuck B10	4	6	5.0	G1/4o	6	0.38	**P1V-S017M0066**

Accessories for Drilling Motor P1V-S017M

Standard Drill Chuck	Order Code
Diameters 0.5 – 6 mm/B10	**P1V-6/804655**
Other Accessories	
Outlet Hose	**P1V-6/806112**
Seal for Outlet Hose	**P1V-6/823221**
Outlet Connection Parallel	**P1V-6/302923A**

NOTE! All technical data is based on a working pressure of 6 bar.

Dimensions, see page K52
Permitted shaft loadings, see page K59
Service kits, see page K62

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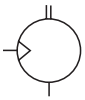
Drilling Motor P1V-S025N

A small drilling motor for moderately heavy drilling operations.

The standard collet chuck is for 6 mm shaft diameter.
For other diameters, select a different collet chuck as an accessory.

The motor has a built-in silencer for exhaust air. If lower noise levels are required,
or if you want the exhaust air to be collected, the relevant accessories are available.



Data for Drilling Motor P1V-S025N

Max. Power	Free Speed	Version	Drilling in Steel	Drilling in Aluminium	Air Consumption at Max. Power	Conn.	Min Pipe ID	Weight	Order Code
kW	rpm	mm	mm	l/s			mm	Kg	
0.250	17000	Collet Chuck 6 mm	—	6	6.3	G1/4o	6	0.80	**P1V-S025N0H00**
0.250	4800	Collet Chuck 6 mm	4	6	6.3	G1/4o	6	0.80	**P1V-S025N0480**
0.250	2500	Collet Chuck 6 mm	6	6	6.3	G1/4o	6	0.80	**P1V-S025N0250**
0.250	1400	Collet Chuck 6 mm	6	6	6.3	G1/4o	6	0.80	**P1V-S025N0140**
0.250	700	Collet Chuck 6 mm	6	—	6.3	G1/4o	6	0.80	**P1V-S025N0070**
0.250	350	Collet Chuck 6 mm	6	—	6.3	G1/4o	6	0.80	**P1V-S025N0035**

Accessories for Drilling Motor P1V-S025N

Collet Chucks	Order Code
Collet Chuck Ø3 mm	**P1V-6/312681**
Collet Chuck Ø4 mm	**P1V-6/312684**
Collet Chuck Ø5 mm	**P1V-6/312686**
Collet Chuck Ø6 mm	**Standard**
Collet Chuck Ø1/8"	**P1V-6/312682**
Collet Chuck Ø1/4"	**P1V-6/312689**
Other Accessories	
Outlet Connection Straight	**P1V-6/313179A**
Outlet Hose Ø23 x 28 mm 0.75 m long	**P1V-6/806110**
Outlet Connection Parallel	**P1V-6/388378A**

NOTE! All technical data is based on a working pressure of 6 bar.

Installation brackets, see page K33
Dimensions, see page K53
Permitted shaft loadings, see page K59
Service kits, see page K62

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Wadsworth, Ohio
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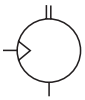
Drilling Motor P1V-S025M

A small drilling motor for moderately heavy drilling operations.

Select drill chucks or quick-release chucks as accessories as necessary.

The motor has a built-in silencer for exhaust air. If lower noise levels are required,
or if you want the exhaust air to be collected, the relevant accessories are available.



Data for Drilling Motor P1V-S025N

Max. Power	Free Speed	Version	Drilling in Steel	Drilling in Aluminium	Air Consumption at Max. Power	Conn.	Min Pipe ID	Weight	Order Code
kW	rpm	mm	mm	l/s			mm	Kg	
0.250	17000	For Drill Chuck B12	—	6	6.3	G1/4o	6	0.80	**P1V-S025M0H00**
0.250	4800	For Drill Chuck B12	4	6	6.3	G1/4o	6	0.80	**P1V-S025M0480**
0.250	2500	For Drill Chuck B12	6	8	6.3	G1/4o	6	0.80	**P1V-S025M0250**
0.250	1400	For Drill Chuck B12	8	10	6.3	G1/4o	6	0.80	**P1V-S025M0140**
0.250	700	For Drill Chuck B12	10	—	6.3	G1/4o	6	0.80	**P1V-S025M0070**
0.250	350	For Drill Chuck B12	10	—	6.3	G1/4o	6	0.80	**P1V-S025M0035**

Accessories for Drilling Motor P1V-S025M

Name	Order Code
Standard Drill Chuck Diameters 0.8 – 10 mm/B12	**P1V-6/804650**
Quick-release Chuck Diameters 0.5 – 8 mm/B12	**P1V-6/804661**
Other Accessories	
Outlet Connection Straight	**P1V-6/3131179A**
Outlet Hose Ø23 x 28 mm 0,75 m long	**P1V-6/806110**
Outlet Connection Parallel	**P1V-6/388378A**

NOTE! All technical data is based on a working pressure of 6 bar.

Installation brackets, see page K33
Dimensions, see page K53
Permitted shaft loadings, see page K59
Service kits, see page K62

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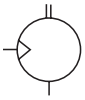
Drilling Motor P1V-S040M

Our large drilling motor is used for small-scale heavy drilling operations
requiring considerable feed force.

Select drill chucks or quick-release chucks as accessories as necessary.

The motor has a built-in silencer for exhaust air. If lower noise levels are required,
or if you want the exhaust air to be collected, the relevant accessories are available.



Data for Drilling Motor P1V-S040M

Max. Power	Free Speed	Version	Drilling in Steel	Drilling in Aluminium	Air Consumption at Max. Power	Conn.	Min Pipe ID	Weight	Order Code
kW	rpm	mm	mm	l/s			mm	Kg	
0.400	17000	For Drill Chuck B12	—	6	8.0	G1/4o	6	0.80	**P1V-S040M0H00**
0.400	4800	For Drill Chuck B12	4	6	8.0	G1/4o	6	0.80	**P1V-S040M0480**
0.400	2500	For Drill Chuck B12	6	8	8.0	G1/4o	6	0.80	**P1V-S040M0250**
0.400	1400	For Drill Chuck B12	6	10	8.0	G1/4o	6	0.80	**P1V-S040M0140**

Accessories for Drilling Motor P1V-S040M

Name	Order Code
Standard Drill Chuck Diameters 0,8 – 10 mm/B12	**P1V-6/804650**
Quick-release Chuck Diameters 0,5 – 8 mm/B12 (Cannot be used for Drilling Motor P1V-S040M0H00)	**P1V-6/804661**
Other Accessories Outlet Connection Straight	**P1V-6/3131179A**
Outlet Hose Ø23 x 28 mm 0,75 m long	**P1V-6/806110**
Outlet Connection Parallel	**P1V-6/388378A**

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NOTE! All technical data is based on a working pressure of 6 bar.

Installation brackets, see page K33
Dimensions, see page K53
Permitted shaft loadings, see page K59
Service kits, see page K62

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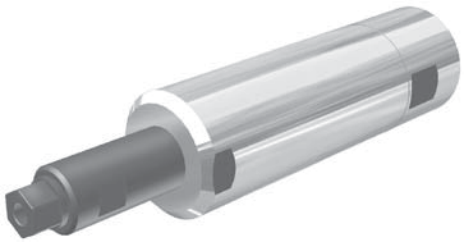
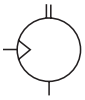
Milling motor P1V-S040N

This motor was designed for milling plastic components, but it can also be used for milling other materials.

The motor has a built-in silencer for exhaust air. If lower noise levels are required,
or if you want the exhaust air to be collected, the relevant accessories are available.





Data for Drilling Motor P1V-S040N

Max. Power	Free Speed	Version	Drilling in Steel	Drilling in Aluminium	Air Consumption at Max. Power	Conn.	Min Pipe ID	Weight	Order Code
kW	rpm	mm	mm	l/s			mm	Kg	
0.400	20000	Collet Chuck 8 mm	8	10	5.0	G1/4o	6	0.80	**P1V-S040N0H00**

Accessories for Drilling Motor P1V-S040N

Collet Chucks	Order Code
Collet Chuck Ø3 mm	**P1V-6/312690**
Collet Chuck Ø4 mm	**P1V-6/312692**
Collet Chuck Ø5 mm	**P1V-6/312693**
Collet Chuck Ø6 mm	**P1V-6/312694**
Collet Chuck Ø8 mm	**Standard**
Collet Chuck Ø1/8"	**P1V-6/312691**
Collet Chuck Ø1/4"	**P1V-6/312695**
Other Accessories	
Outlet Connection Straight	**P1V-6/313179A**
Outlet Hose Ø23 x 28 mm 0.75 m long	**P1V-6/806110**
Outlet Connection Parallel	**P1V-6/388378A**

NOTE! All technical data is based on a working pressure of 6 bar.

Dimensions, see page K54
Permitted shaft loadings, see page K59
Service kits, see page K62

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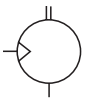
Grinding Motor P1V-S009N

The grinding motor is used for small-scale point grinding and small-scale milling where
the high speed is an advantage. It has proved to be very useful for drilling small holes
and milling thin slits in PCBs in the electronics industry.
In this application, the high speed means that the holes and slits are free of
burrs on the underside.



Data for Grinding Motor P1V-S009N

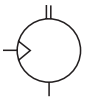
Max. Power	Free Speed	Version	Point Grinding Diameter Max.	Milling Diameter Max.	Air Consumption at Max. Power	Conn.	Min Pipe ID	Weight	Order Code
kW	rpm	mm	mm	l/s			mm	Kg	
0.090	100000	Collet Chuck 3 mm	5	3	2.0	Pipe 6/4	4	0.3	**P1V-S009N0A000**

NOTE! All technical data is based on a working pressure of 6 bar.

Dimensions, see page K54
Permitted shaft loadings, see page K59

Grinding motor P1V-S020N

This grinding motor is used when larger-scale point grinding is required.
The motor can also be used for light milling operations.
The motor has a built-in silencer for exhaust air.



Data for Grinding Motor P1V-S020N

Max. Power	Free Speed	Version	Point Grinding Diameter Max.	Milling Diameter Max.	Air Consumption at Max. Power	Conn.	Min Pipe ID	Weight	Order Code
kW	rpm	mm	mm	l/s			mm	Kg	
0.200	30000	Collet Chuck 6 mm	25	10	6.3	G1/40	6	0.5	**P1V-S020N0X00**

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Accessories for Grinding Motor P1V-S020N

Collet Chucks	Order Code
Collet Chuck Ø3 mm	**P1V-6/312681**
Collet Chuck Ø4 mm	**P1V-6/312684**
Collet Chuck Ø5 mm	**P1V-6/312686**
Collet Chuck Ø6 mm	**Standard**
Collet Chuck Ø1/8"	**P1V-6/312682**
Collet Chuck Ø1/4"	**P1V-6/312689**

NOTE! All technical data is based on a working pressure of 6 bar.

Dimensions, see page K54
Permitted shaft loadings, see page K59
Service kits, see page K62

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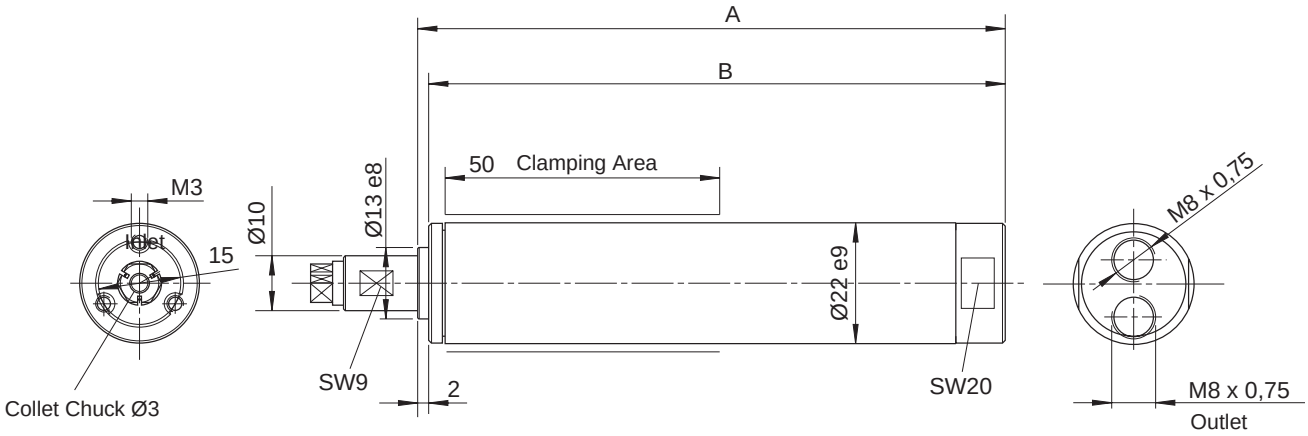
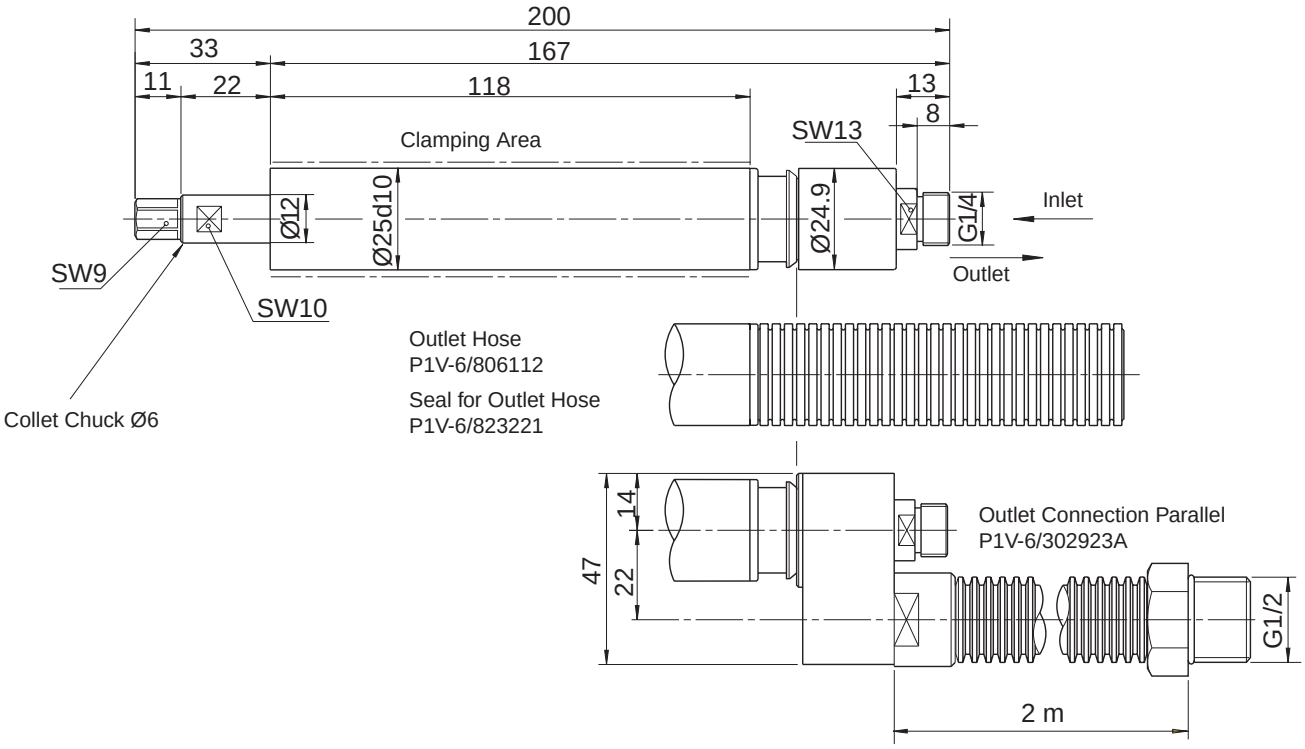
Drilling Motor P1V-S008N



	A	B
P1V-S008N0Q00, P1V-S008N0700	98	96
P1V-S008N0190, P1V-S008N0130	107	105

Drilling Motor P1V-S017N



CAD drawings on the Internet
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AirCad™ Drawing Library

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Air Motors

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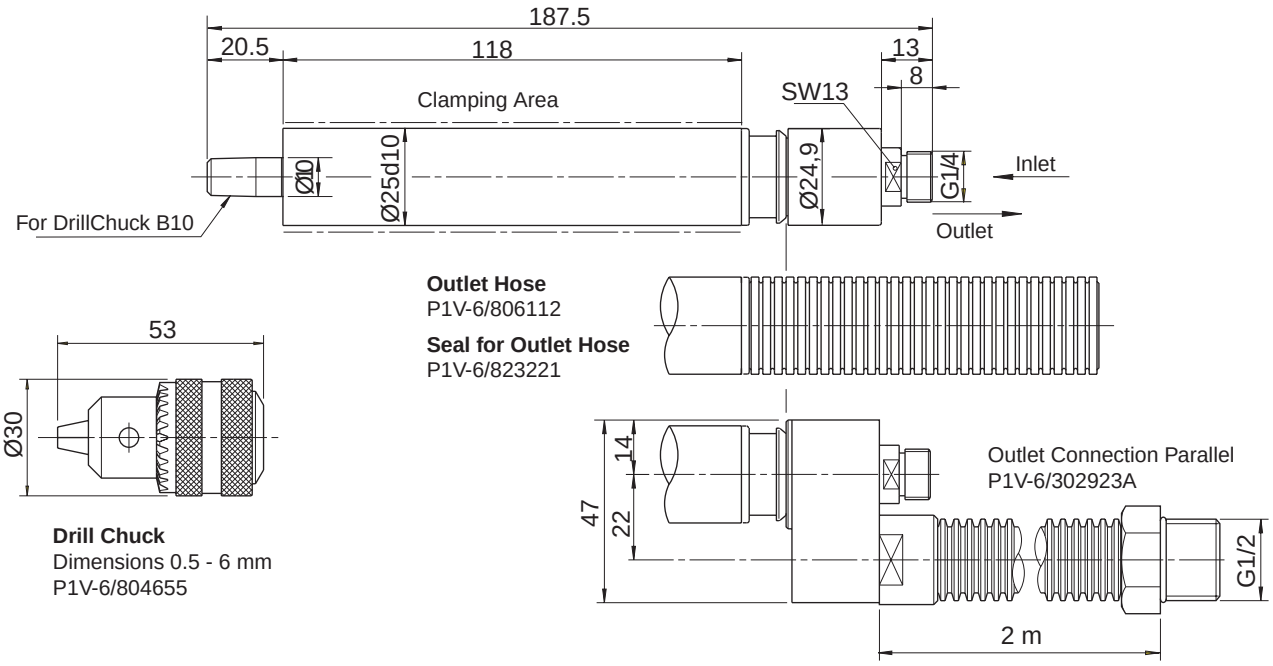
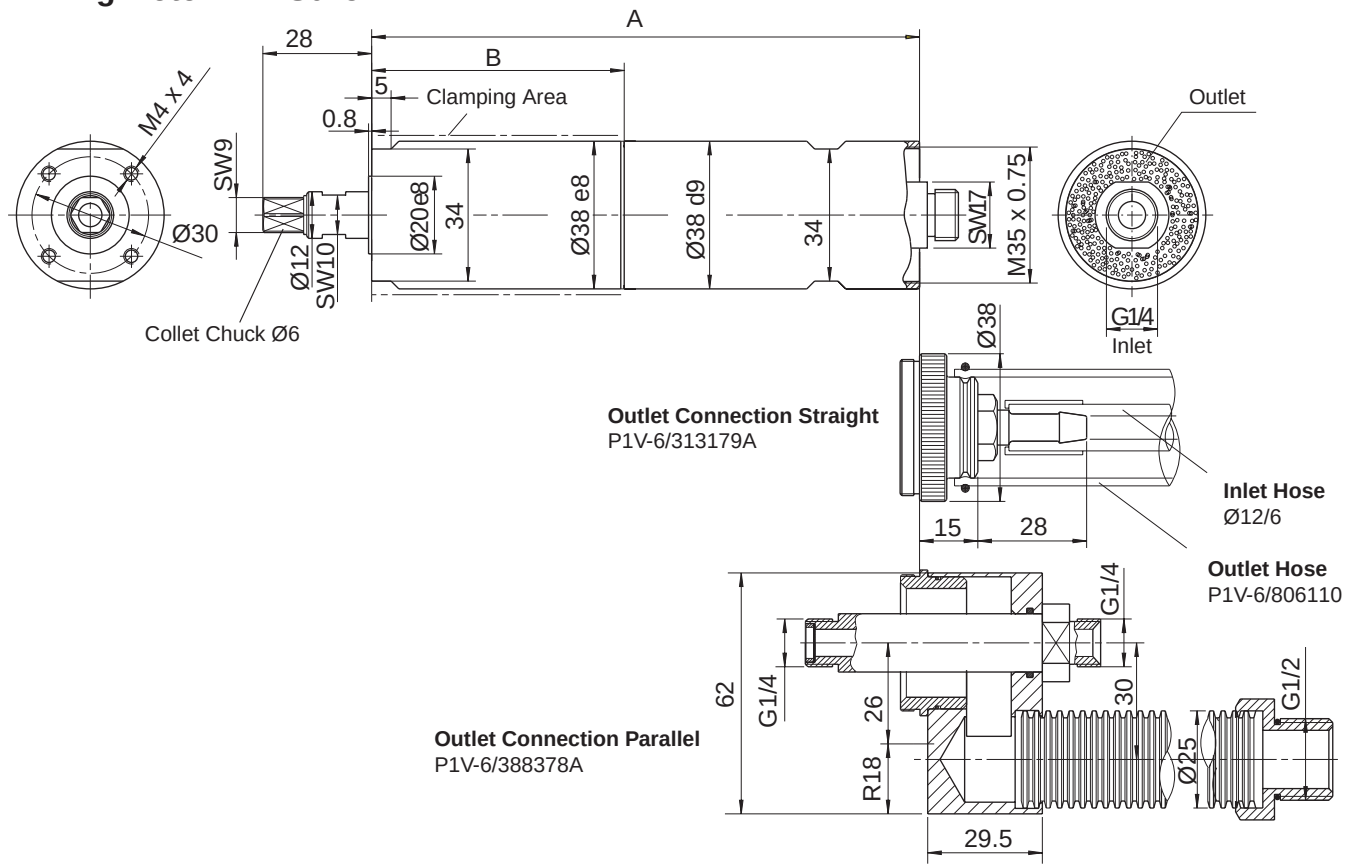
Drilling Motor P1V-S017M



Drilling Motor P1V-S025N



	A	B
P1V-S025N0H00, P1V-S025N0480, P1V-S025N0250	141	65
P1V-S025N0H00, P1V-S025N0480, P1V-S025N0250	157	81

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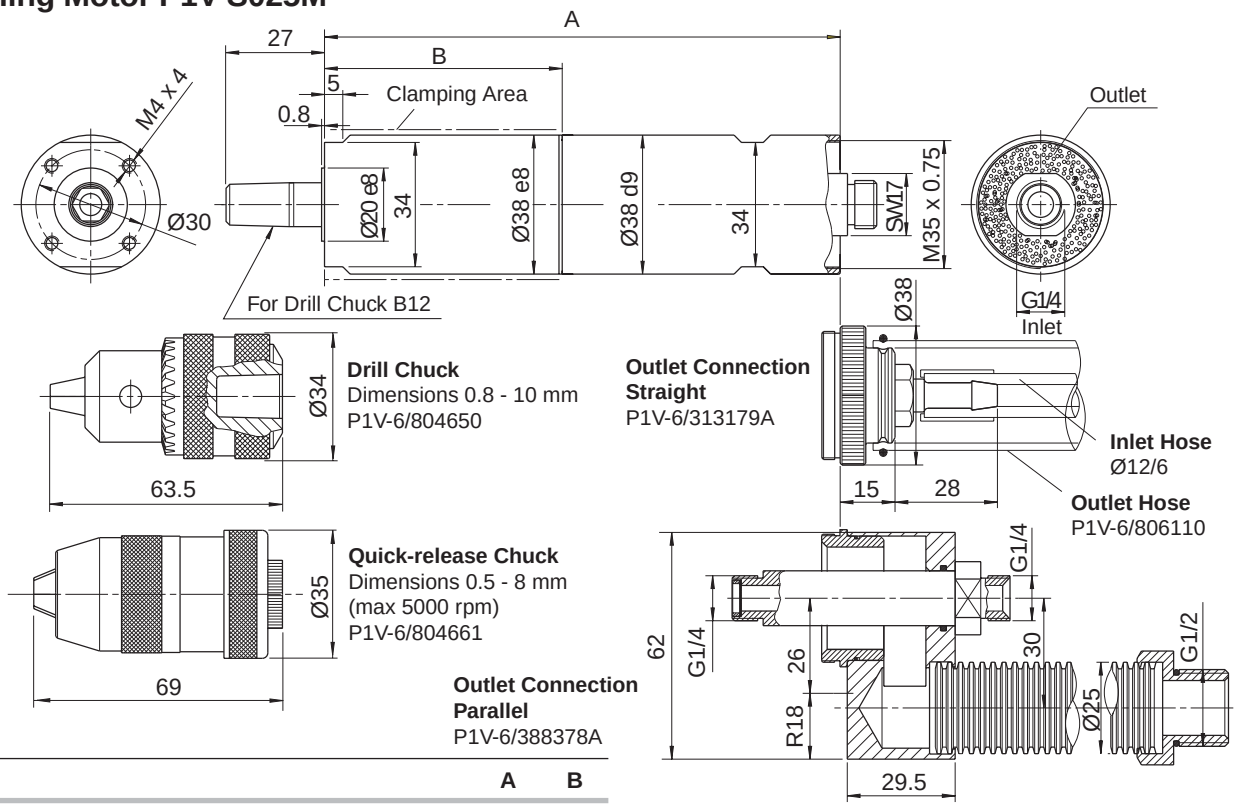
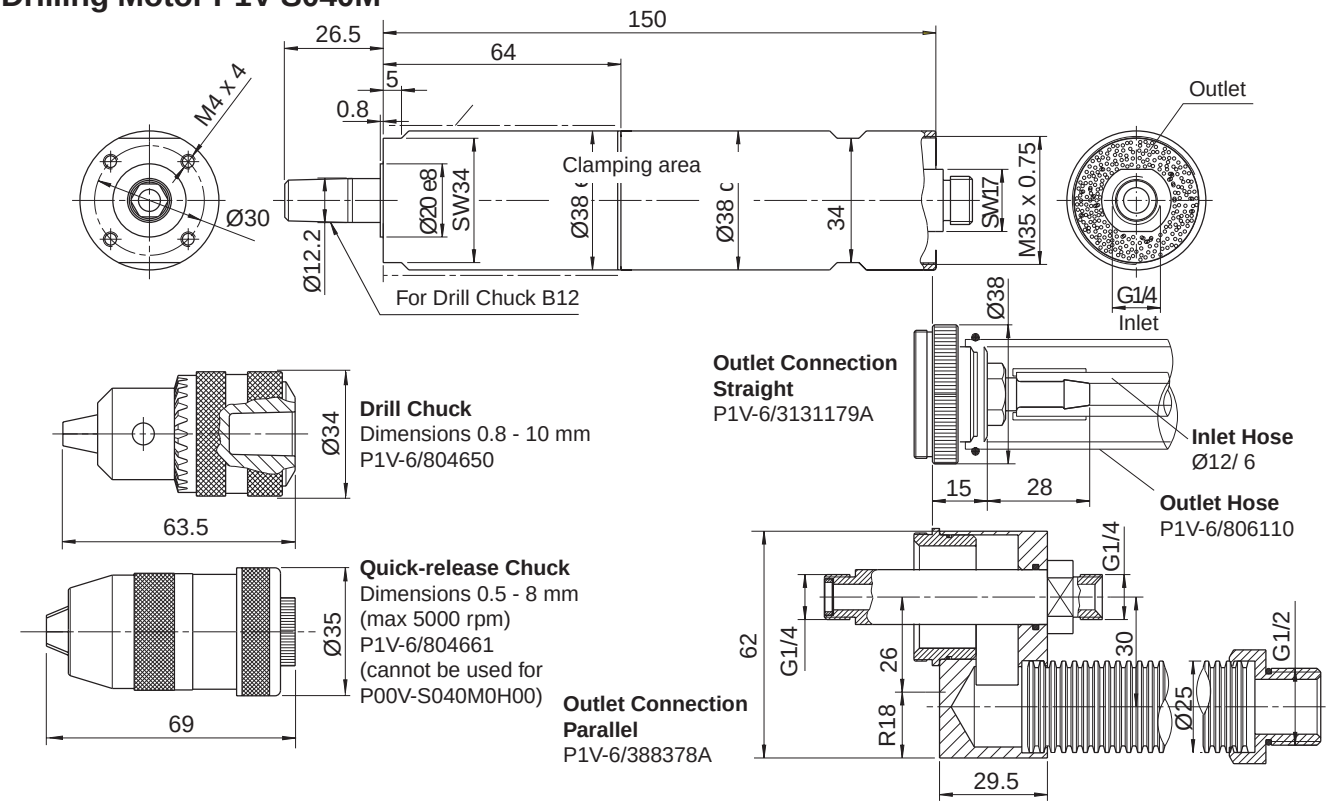
Drilling Motor P1V-S025M



	A	B
P1V-S025M0H00, P1V-S025M0480, P1V-S025M0250	141	65
P1V-S025M0140, P1V-S025M0070, P1V-S025M0035	157	81

Drilling Motor P1V-S040M



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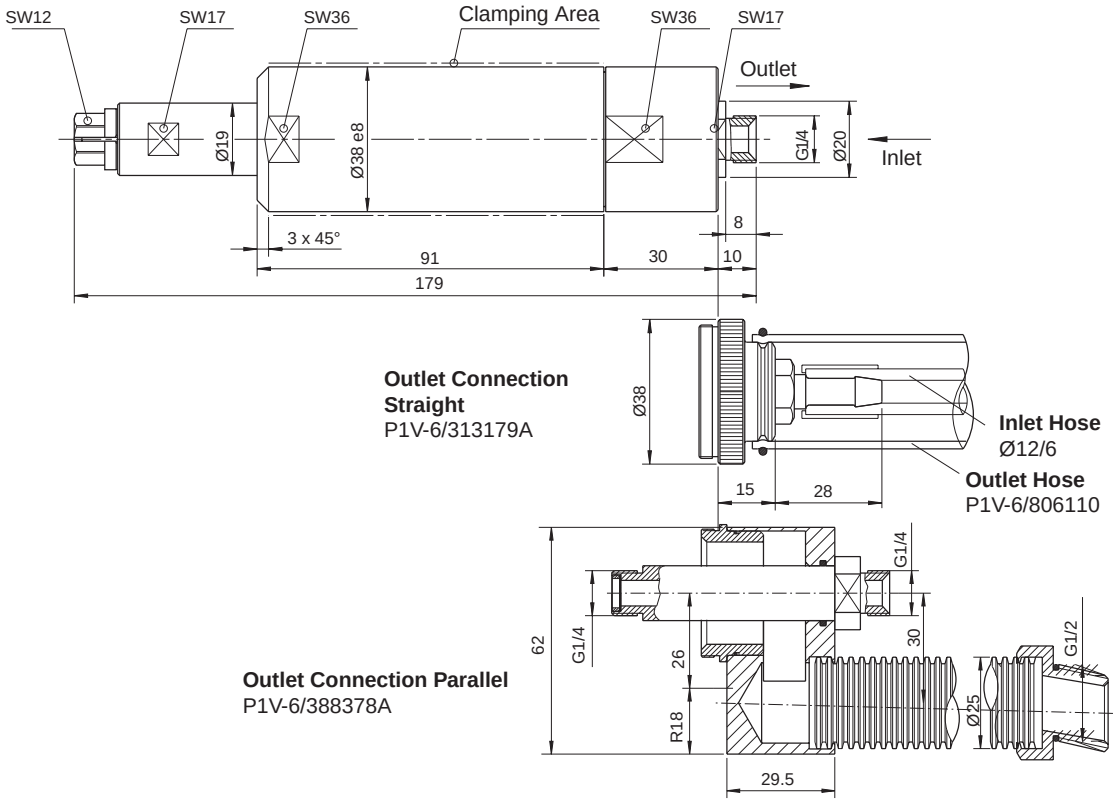
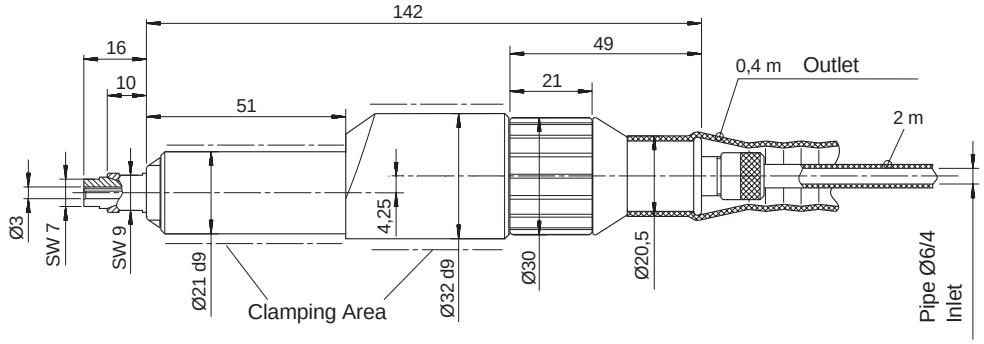
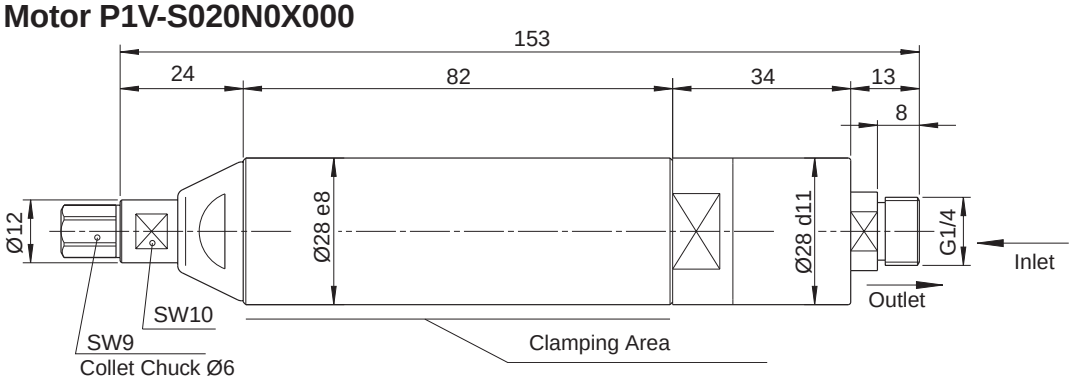
Milling Motor P1V-S040N



Grinding Motor P1V-S009N0A000



Grinding Motor P1V-S020N0X000



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Theoretical calculations

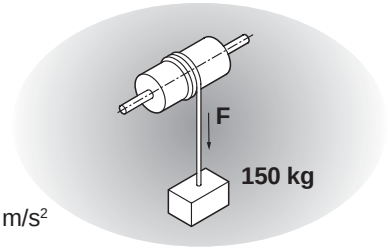
This section provides you with the background you need in order to select the right air motor for common applications. The first four parts explain the direct physical relationships between:

Force - Torque - Speed - Power Requirement

Before selecting an air motor, you need to know the torque required by the application at the necessary speed. Sometimes, the torque and the speed are not known but the power requirement and the speed of movement are. You can use the following formulas to calculate the speed and torque.

Power

The power requirement is always calculated in N.



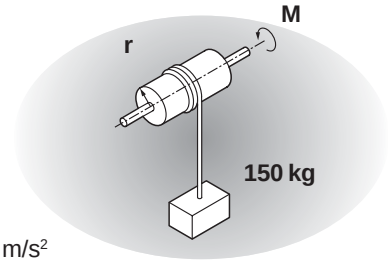
Formula:
$F = m \times g$

F = power in N
m = mass in kg
g = gravitation (9.81) in m/s^2

In this example, the mass is 150 kg
F = 150 x 9.81 N
F = 1470 N

Torque

Torque is the force applied to produce rotational motion (rotational force) or the force applied in the opposite direction. It is the product of the rotational force F and the distance from the pivot point (radius or moment arm)



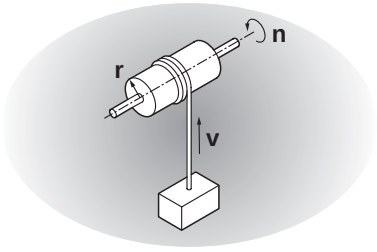
Formula:
$M = m \times g \times r$

M = torque in Nm
m = mass in kg
g = gravitation (9.81) in m/s^2
r = radius or moment arm in m

In this example, the drum diameter is 300 mm, which means the radius r = 0,15 m, and the mass is 150kg.
M = 150 x 9,81 x 0.15 Nm
M = 221 Nm

Speed

The required motor speed can be calculated if the speed of movement and the radius (diameter) are known.



$n = v \times 60/(2 \times \pi \times r)$

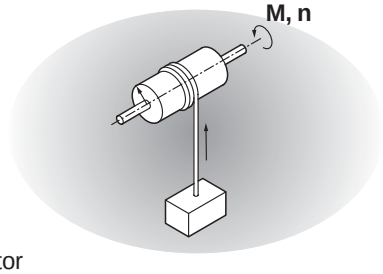
n = motor speed in rpm
v = speed of movement in m/sec
r = radius in m
π = constant (3.14)

In this example, the speed of movement is 1.5 m/s and the drum diameter is 300 m (radius r = 0.15 m)

n = 1.5 x 60/(2 x π x 0.15) rpm
n = 96 rpm

Power Requirement

The power requirement can be calculated if the motor speed and torque are known.



$P = M \times n/9550$

P = power in kW
M = torque in Nm
n = rpm
9550 = conversion factor

In this example, a torque of 1.25 Nm is required at a speed of 1500 rpm.
P = 1.25 x 1500/9550
P = 0.196 kW or approx. 200 Watt

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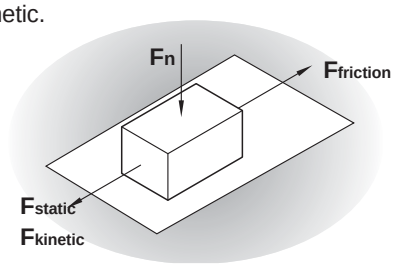
Frictional Forces Between Two Objects

A frictional force always occurs between two objects with surfaces in contact with each other. It is always exerted against the direction of movement.

The frictional force is either static or kinetic. When selecting an air motor, we need to consider the larger of the two forces, static or kinetic.



The size of the static frictional force or the kinetic frictional force is the product of the normal force F_n and the coefficient of static friction (μ_0), or the product of the normal force F_n and the coefficient of kinetic friction (μ).
The size of the contact surface between the objects is irrelevant.

Formula:

$F_{static} = F_n \times \mu_0$
$F_{kinetic} = F_n \times \mu$

$F_n = m \times g$

F_{static} = static friction in N
$F_{kinetic}$ = kinetic friction in N
F_n = force from object in N
m = mass in kg
g = gravitation (9.81) in m/s^2

Material		Coefficient of Static Friction μ_0	
		Dry	Lubricated
Bronze	Bronze	0.28	0.11
Bronze	Grey Iron	0.28	0.16
Grey Iron	Grey Iron	—	0.16
Steel	Bronze	0.27	0.11
Steel	Ice	0.027	—
Steel	Grey Iron	0.20	0.10
Steel	Steel	0.15	0.10
Steel	White Metal	—	—
Wood	Ice	—	—
Wood	Wood	0.65	0.16
Leather	Grey Iron	0.55	0.22
Brake Lining	Steel	—	—
Steel	Nylon (polyamide)	—	—

Material		Coefficient of Static Friction μ_0	
		Dry	Lubricated
Bronze	Bronze	0.2	0.06
Bronze	Grey Iron	0.21	0.08
Grey Iron	Grey Iron	—	0.12
Steel	Bronze	0.18	0.07
Steel	Ice	0.014	—
Steel	Grey Iron	0.16	0.05
Steel	Steel	0.10	0.05
Steel	White Metal	0.20	0.04
Wood	Ice	0.035	—
Wood	Wood	0.35	0.05
Leather	Grey Iron	0.28	0.12
Brake Lining	Steel	0.55	0.40
Steel	Nylon (polyamide)	0.5	0.10

Example: A steel component with a weight of 500 kg is to be pulled across bronze plate without lubrication. What will the frictional force be when the component moves?

$F_{static} = F_n \times \mu_0$

$F_{kinetic} = F_n \times \mu$

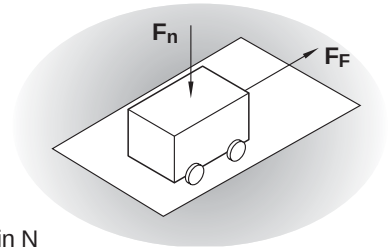
$F_{static} = 500 \times 9.81 \times 0.27 = 1324$ N

$F_{kinetic} = 500 \times 9.81 \times 0.18 = 883$ N

The static frictional force should always be compared with the force provided by the motor when it starts.

Kinetic Resistance

Kinetic resistance is a term expressing the total resistance, consisting of rolling resistance and the frictional force in the bearing.



Formula:

$F_F = \mu_F \times F_n$

F_F = kinetic resistance in N
μ_F = coefficient of kinetic resistance
F_n = force from object in N

Coefficient of Kinetic Resistance:

Object	Coefficient of Kinetic Resistance
Railway vehicle on steel rails	0.0015 to 0.0030
Vehicle with rubber wheel on asphalt	0.015 to 0.03

Example:

A railway carriage with a weight of 2 tons is to move over flat rails. What will the kinetic resistance be?

$F_F = \mu_F \times F_n$
$F_F = 0.0030 \times 2 \times 1000 \times 9.81$
$F_F = 4.86$ N

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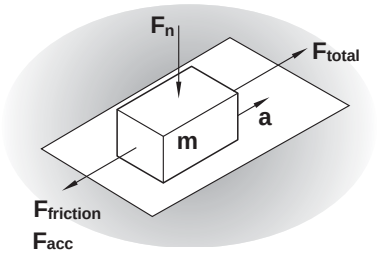
Moving a component over a base, with friction between them



The force required to move the component consists of two parts - a frictional force to move the component over the base, and an acceleration force

$F_{tot} = F_{friction} + F_{acc}$

$F_{acc} = m \times a$

$F_{tot} = F_{friction} + m \times a$

F_{tot} = the total force required in order to move the object in N

$F_{friction}$ = frictional force in N (either F_{static} or $F_{kinetic}$ depending on which is the greater force)

F_{acc} = acceleration force in N

m = mass in kg

a = acceleration in m/s^2

A steel component weighing 500 kg is to be pulled over a dry steel plate with an acceleration of 0.1 m/s^2. What is the total force required to produce this movement?

$F_{tot} = F_{kinetic} + F_{acc}$

$F_{tot} = F_{kinetic} + m \times a$

$F_{tot} = Fn \times u + m \times a$

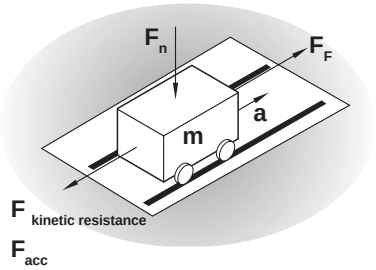
$F_{tot} = 500 \times 9{,}81 \times 0.15 + 500 \times 0.1$

$F_{tot} = 735.75 + 50$

$F_{tot} = 785.75$ N

Answer: A force of 780 N is required to produce this movement.

Moving a carriage over rails, with kinetic resistance between them



The force required to move the component consists of two parts - a kinetic resistance to move the component over the base, and an acceleration force

$F_{tot} = F_{kinetic\ resistance} + F_{acc}$

$F_{acc} = m \times a$

$F_{tot} = F_{kinetic\ resistance} + m \times a$

F_{tot} = the total force required in order to move the object in N

$F_{kinetic\ resistance}$ = total kinetic resistance in N

F_{acc} = acceleration force in N

m = mass in kg

a = acceleration in m/s^2

A carriage weighing 2500 kg is to be pulled over steel rails with an acceleration of 0,2 m/s^2. What is the total force required to produce this movement?

$F_{tot} = F_{kinetic\ resistance} + F_{acc}$

$F_{tot} = u_F \times F_N + m \times a$

$F_{tot} = 0.0030 \times 2500 \times 9.81 + 2500 \times 0.2$

$F_{tot} = 6.1 + 500$

$F_{tot} = 506$ N

Answer: A force of 510 N is required to produce this movement.

In Practice

These calculations only produce values as they would be under optimum conditions. There must be no inclines in either direction. In applications using carriages, the rails must be perfectly flat without any inclines, the wheels must be perfectly round and there must be nothing on the rails (grains of sand, etc.). There must also be no effects from wind, etc.
In addition, there is always uncertainty with regard to the compressed air supply. How can we guarantee a pressure of 6 bar to the inlet port of the air motor?

Tip: calculate the required theoretical values for the air motor and assume a safety factor of 10 for the frictional force or kinetic resistance, and add this to the acceleration force. If the motor proves to be too powerful in practice, the supply air can always be regulated by throttling or pressure regulation. If you select a motor that is not powerful enough, on the other hand, the only option is to replace it.

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Permitted Shaft Loadings

Air and Brakemotors

Max. permitted load on output shaft for motors (based on 10,000,000 rpm at input shaft with 90 % probable service life for ball bearings).

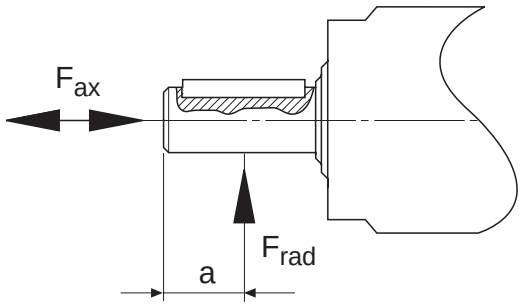

Fig 1: Load on output shaft for basic motor with keyed shaft.

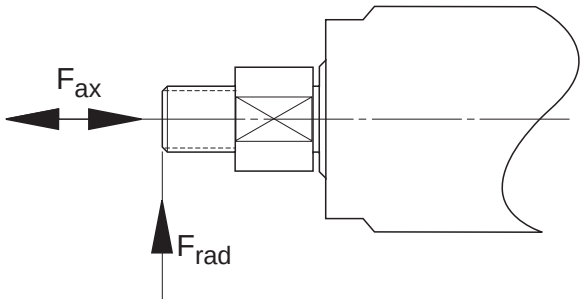

Fig. 2: Load on output shaft for basic motor with threaded shaft.

Keyed Shaft

Order Code	F_{ax} (N)	F_{rad} (N)	a (mm)
P1V-S002A	140	180	6
P1V-S008A	200	220	7
P1V-S012A	380	160	9
P1V-S020A	570	720	12
P1V-S020A0011	1100	1200	22
P1V-S020A0006	1100	1200	22
P1V-S030A0023	1100	1200	22
P1V-S030A0010	1100	1200	22
P1V-S030A0E50	570	1130	14
P1V-S030A0460	570	1130	14
P1V-S030A0240	570	1130	14
P1V-S030A0140	570	1130	14
P1V-S030A0060	790	1070	15
P1V-S030A0028	790	1070	15
P1V-S030A0018	790	1070	15
P1V-S030A0005	790	1070	15
P1V-S060A0E00	1110	1300	15
P1V-S060A0400	1110	1300	15
P1V-S060A0270	1110	1300	15
P1V-S060A0170	1110	1300	15
P1V-S060A0072	1110	1300	15
P1V-S060A0048	1130	2090	18
P1V-S060A0030	1130	2090	18
P1V-S060A0010	1130	2090	18
P1V-S120A0800	2330	2260	18
P1V-S120A0270	2330	2260	18
P1V-S120A0110	2330	2260	18
P1V-S120A0078	2330	2700	30
P1V-S120A0032	2330	2700	30
P1V-S120A0012	2330	2700	30

Threaded Shaft

Order Code	F_{ax} (N)	F_{rad} (N)
P1V-S012D	380	110
P1V-S020D	570	450
P1V-S030D0E50	570	860
P1V-S030D0460	570	860
P1V-S030D0240	570	860
P1V-S030D0140	570	860
P1V-S030D0060	790	820
P1V-S030D0028	790	820
P1V-S030D0018	790	820
P1V-S030D0005	790	820

F_{rad} = Radial loading (N)
F_{ax} = Axial loading (N)

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Permitted Shaft Loadings

Drilling, Milling and Grinding Motors

Max. permitted load on output shaft for motors (based on 10,000,000 rpm at input shaft with 90 % probable service life for ball bearings).

Drilling Motors with Collet Chuck

Order Code	F_{ax} (N)	F_{rad} (N)	a (mm)
P1V-S008N	200	75	25
P1V-S017N	380	50	25
P1V-S025N	750	260	25

Drilling Motors with Drill Chuck

Order Code	F_{ax} (N)	F_{rad} (N)	a (mm)
P1V-S017M	380	35	60
P1V-S025M	380	150	70
P1V-S040M	750	150	70

Milling Motor

Order Code	F_{ax} (N)	F_{rad} (N)	a (mm)
P1V-S040N*	30	250	25

Grinding Motors

Order Code	F_{ax} (N)	F_{rad} (N)	a (mm)
P1V-S009N*	2	10	25
P1V-S020N*	16	70	25

F_{rad} = Radial loading (N)
F_{ax} = Axial loading (N)

* For the milling motor and grinding motor, these loadings are calculated for 1000 hours of operation

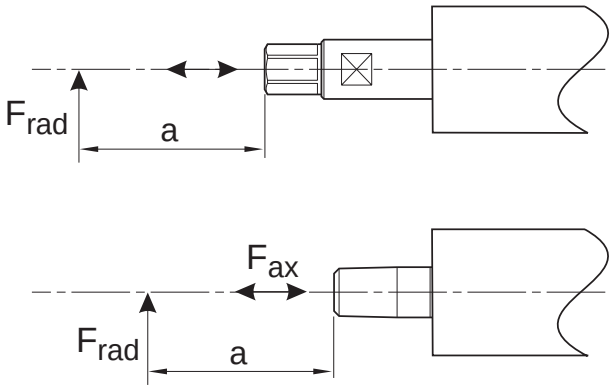

Fig 3: Load on output shaft for drilling, milling and grinding motors.

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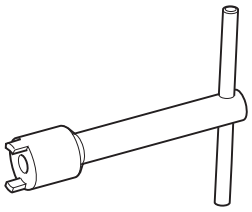
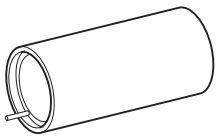
Service Kits for P1V-S Motors

The following kits are available for the basic motors, consisting of vanes, (springs), silencers, O-rings, seals and 50 g of grease: (USDA-H1 approved):

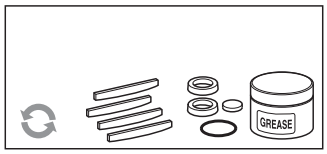


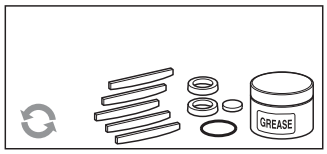


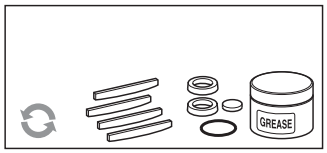
Installation Tools

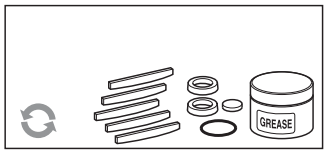
For Motor	Order Code
P1V-S012	**8204160049**

For Motor	Order Code
P1V-S020, P1V-S030	**8204160112**









Service Kit, Vanes for Intermittent Lubrication-free Operation

For Motor	Order Code
P1V-S002A	**P1V-6/446083A**
P1V-S008A	**P1V-6/446084A**
P1V-S012A/D0 (to serial no 948688)	**9121720601**
P1V-S012A/D0 (from serial no 948689)	**9121720636**
P1V-S020A/D0	**9121720602**
P1V-S030A/D0	**9121720603**
P1V-S060A0E00	**9121720604**
P1V-S060A0400	**9121720604**
P1V-S060A0270	**9121720604**
P1V-S060A0170	**9121720604**
P1V-S060A0072	**9121720604**
P1V-S060A0048	**9121720605**
P1V-S060A0030	**9121720605**
P1V-S060A0010	**9121720605**
P1V-S120A0800	**9121720606**
P1V-S120A0270	**9121720606**
P1V-S120A0110	**9121720606**
P1V-S120A0078	**9121720607**
P1V-S120A0032	**9121720607**
P1V-S120A0012	**9121720607**

Service Kit, Vanes for Continuous Lubrication-free Operation, Option "C"

For Motor	Order Code
P1V-S012A/DC (to serial no 948688)	**9121720608**
P1V-S012A/DC (from serial no 948689)	**9121720637**
P1V-S020A/DC	**9121720609**
P1V-S030A/DC	**9121720610**
P1V-S060ACE00	**9121720611**
P1V-S060AC400	**9121720611**
P1V-S060AC270	**9121720611**
P1V-S060AC170	**9121720611**
P1V-S060AC072	**9121720611**
P1V-S060AC048	**9121720612**
P1V-S060AC030	**9121720612**
P1V-S060AC010	**9121720612**
P1V-S120AC800	**9121720613**
P1V-S120AC270	**9121720613**
P1V-S120AC110	**9121720613**
P1V-S120AC078	**9121720614**
P1V-S120AC032	**9121720614**
P1V-S120AC012	**9121720614**

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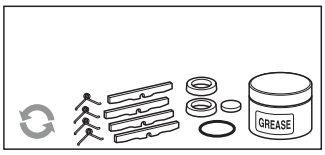
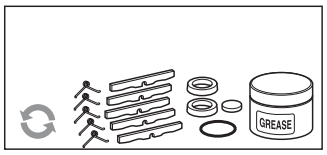
Service Kits for P1V-S Motors

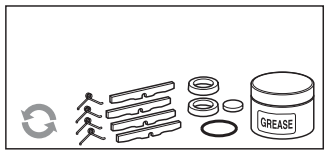
The following kits are available for the basic motors, consisting of vanes, (springs), silencers, O-rings, seals and 50 g of grease: (USDA-H1 approved):

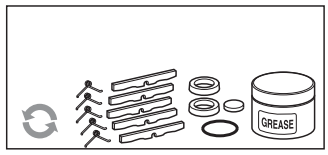




Service Kit, Spring-loaded Vanes for Intermittent Lubrication-free Operation, Option "Z"

For Motor	Order Code
P1V-S012A/DZ (to serial no 948688)	**9121720615**
P1V-S012A/DZ (from serial no 948689)	**9121720638**
P1V-S020A/DZ	**9121720616**
P1V-S030A/DZ	**9121720617**
P1V-S060AZE00	**9121720618**
P1V-S060AZ400	**9121720618**
P1V-S060AZ270	**9121720618**
P1V-S060AZ170	**9121720618**
P1V-S060AZ072	**9121720618**
P1V-S060AZ048	**9121720619**
P1V-S060AZ030	**9121720619**
P1V-S060AZ010	**9121720619**
P1V-S120AZ800	**9121720620**
P1V-S120AZ270	**9121720620**
P1V-S120AZ110	**9121720620**
P1V-S120AZ078	**9121720621**
P1V-S120AZ032	**9121720621**
P1V-S120AZ012	**9121720621**





Service Kit, Spring-loaded Vanes for Continuous Lubrication-free Operation, Option "M"

For Motor	Order Code
P1V-S012A/DM (to serial no 948688)	**9121720622**
P1V-S012A/DM (from serial no 948689)	**9121720639**
P1V-S020A/DM	**9121720623**
P1V-S030A/DM	**9121720624**
P1V-S060AME00	**9121720625**
P1V-S060AM400	**9121720625**
P1V-S060AM270	**9121720625**
P1V-S060AM170	**9121720625**
P1V-S060AM072	**9121720625**
P1V-S060AM048	**9121720626**
P1V-S060AM030	**9121720626**
P1V-S060AM010	**9121720626**
P1V-S120AM800	**9121720627**
P1V-S120AM270	**9121720627**
P1V-S120AM110	**9121720627**
P1V-S120AM078	**9121720628**
P1V-S120AM032	**9121720628**
P1V-S120AM012	**9121720628**

Service Kit for Brake Module for Brake Motors

For Motor	Order Code
P1V-S020AD and P1V-S030AD	**P1V-6/446096A**

Comment: To perform a full service on a brake motor, you will need a normal service kit as well as a service kit for the brake module

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Service Kits for Drilling, Milling and Grinding Motors

The following kits are available for the motors, consisting of vanes, (springs), silencers, O-rings, seals and 50 g of grease: (USDA-H1 approved):

Service Kits

For Motor	Order Code
P1V-S008N	**P1V-6/446085A**
P1V-S017N/M	**P1V-6/446086A**
P1V-S025N/M	**P1V-6/446087A**
P1V-S040M	**P1V-6/446088A**

For Motor	Order Code
P1V-S040N	**P1V-6/446088A**

For Motor	Order Code
P1V-S020N	**P1V-6/446090A**

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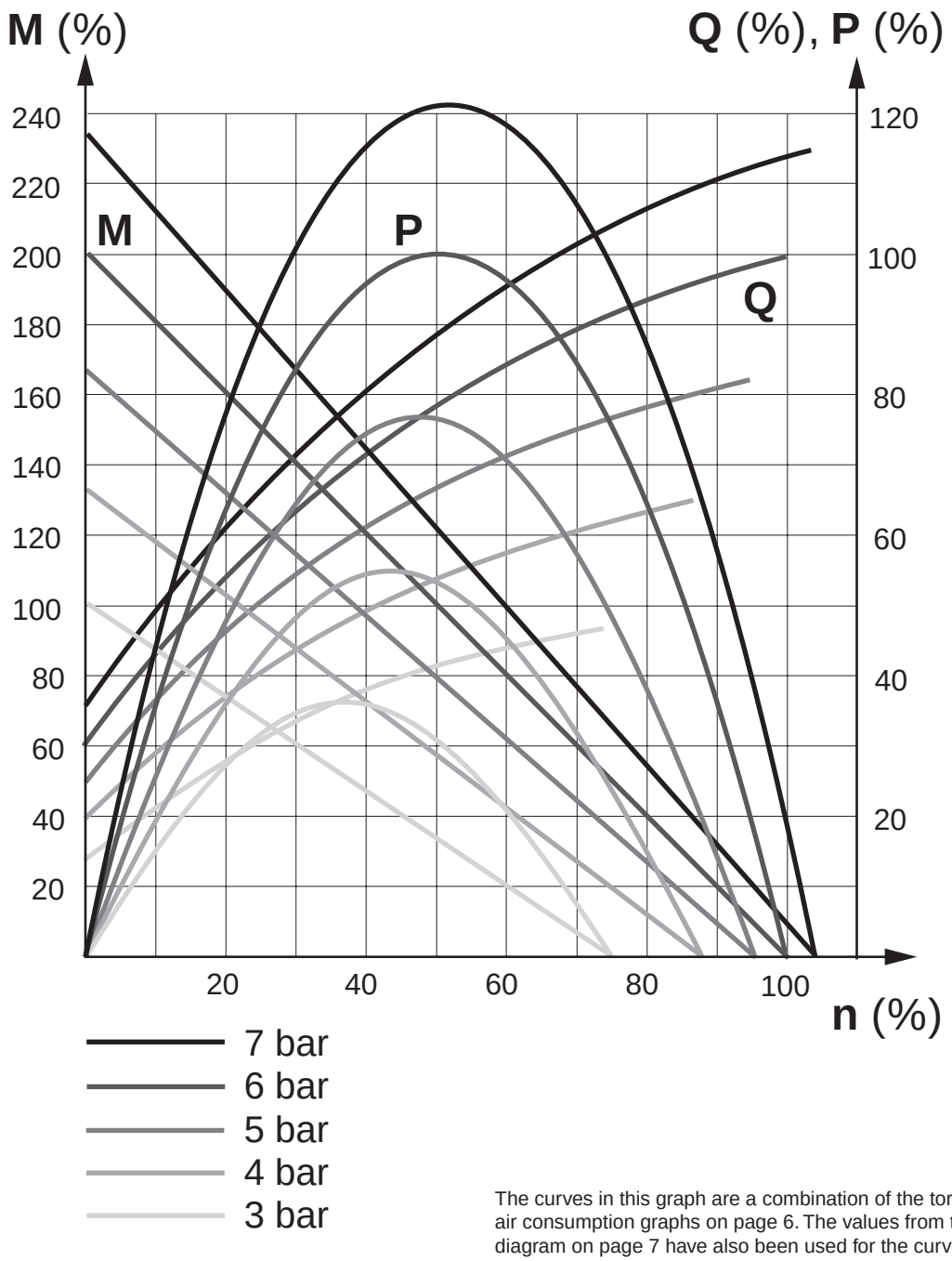
Torque, Power and Air Consumption Graphs



P = power	**Q = air consumption**
M = torque	**n = speed**

The curves in this graph are a combination of the torque, power and air consumption graphs on page 6. The values from the correction diagram on page 7 have also been used for the curves for the different pressure values. The graph also shows that is it very important to ensure that the pressure supplied to the inlet port of the motor is correct, in order to allow the motor to work at maximum capacity. If the valve supplying a large motor is too small, or if the supply line is underspecified, the pressure at the inlet port may be so low that the motor is unable to do its work. One solution would be to upgrade the valve and supply system, or alternatively you could replace the motor with a smaller motor with lower air consumption. The result would be increased pressure at the inlet port, which means that the smaller motor could carry out the necessary work. However, you may need to select a smaller motor with a lower free speed in order to obtain sufficient torque at the outgoing shaft.

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Safety Guide for Selecting and Using Hydraulic, Pneumatic Cylinders and Their Accessories

WARNING: ⚠ FAILURE OF THE CYLINDER, ITS PARTS, ITS MOUNTING, ITS CONNECTIONS TO OTHER OBJECTS, OR ITS CONTROLS CAN RESULT IN:

- **Unanticipated or uncontrolled movement of the cylinder or objects connected to it.**
- **Falling of the cylinder or objects held up by it.**
- **Fluid escaping from the cylinder, potentially at high velocity.**

THESE EVENTS COULD CAUSE DEATH OR PERSONAL INJURY BY, FOR EXAMPLE, PERSONS FALLING FROM HIGH LOCATIONS, BEING CRUSHED OR STRUCK BY HEAVY OR FAST MOVING OBJECTS, BEING PUSHED INTO DANGEROUS EQUIPMENT OR SITUATIONS, OR SLIPPING ON ESCAPED FLUID.

Before selecting or using Parker (The Company) cylinders or related accessories, it is important that you read, understand and follow the following safety information. Training is advised before selecting and using The Company's products.

1.0 General Instructions

1.1 Scope – This safety guide provides instructions for selecting and using (including assembling, installing, and maintaining) cylinder products. This safety guide is a supplement to and is to be used with the specific Company publications for the specific cylinder products that are being considered for use.

1.2 Fail Safe – Cylinder products can and do fail without warning for many reasons. All systems and equipment should be designed in a fail-safe mode so that if the failure of a cylinder product occurs people and property won't be endangered.

1.3 Distribution – Provide a free copy of this safety guide to each person responsible for selecting or using cylinder products. Do not select or use The Company's cylinders without thoroughly reading and understanding this safety guide as well as the specific Company publications for the products considered or selected.

1.4 User Responsibility – Due to very wide variety of cylinder applications and cylinder operating conditions, The Company does not warrant that any particular cylinder is suitable for any specific application. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The hydraulic and pneumatic cylinders outlined in this catalog are designed to The Company's design guidelines and do not necessarily meet the design guideline of other agencies such as American Bureau of Shipping, ASME Pressure Vessel Code etc. The user, through its own
analysis and testing, is solely responsible for:

- Making the final selection of the cylinders and related accessories.
- Determining if the cylinders are required to meet specific design requirements as required by the Agency(s) or industry standards covering the design of the user's equipment.
- Assuring that the user's requirements are met, OSHA requirements are met, and safety guidelines from the applicable agencies such as but not limited to ANSI are followed and that the use presents no health or safety hazards.
- Providing all appropriate health and safety warnings on the equipment on which the cylinders are used.

1.5 Additional Questions – Call the appropriate Company technical service department if you have any questions or require any additional information. See the Company publication for the product being considered or used, or call 1-800-CPARKER, or go to www.parker.com, for telephone numbers of the appropriate technical service department.

2.0 Cylinder and Accessories Selection

2.1 Seals – Part of the process of selecting a cylinder is the selection of seal compounds. Before making this selection, consult the "seal information page(s)" of the publication for the series of cylinders of interest.

The application of cylinders may allow fluids such as cutting fluids, wash down fluids etc. to come in contact with the external area of the cylinder. These fluids may attack the piston rod wiper and or the primary seal and must be taken into account when selecting and specifying seal compounds.

Dynamic seals will wear. The rate of wear will depend on many operating factors. Wear can be rapid if a cylinder is mis-aligned or if the cylinder has been improperly serviced. The user must take seal wear into consideration in the application of cylinders.

2.2 Piston Rods – Possible consequences of piston rod failure or separation of the piston rod from the piston include, but are not limited to are:

- Piston rod and or attached load thrown off at high speed.
- High velocity fluid discharge.
- Piston rod extending when pressure is applied in the piston retract mode.

Piston rods or machine members attached to the piston rod may move suddenly and without warning as a consequence of other conditions occurring to the machine such as, but not limited to:

- Unexpected detachment of the machine member from the piston rod.
- Failure of the pressurized fluid delivery system (hoses, fittings, valves, pumps, compressors) which maintain cylinder position.
- Catastrophic cylinder seal failure leading to sudden loss of pressurized fluid.
- Failure of the machine control system.

Follow the recommendations of the "Piston Rod Selection Chart and Data" in the publication for the series of cylinders of interest. The suggested piston rod diameter in these charts must be followed in order to avoid piston rod buckling.

Piston rods are not normally designed to absorb bending moments or loads which are perpendicular to the axis of piston rod motion. These additional loads can cause the piston rod to fail. If these types of additional loads are expected to be imposed on the piston rod, their magnitude should be made known to our engineering department.

The cylinder user should always make sure that the piston rod is securely attached to the machine member.

On occasion cylinders are ordered with double rods (a piston rod extended from both ends of the cylinder). In some cases a stop is threaded on to one of the piston rods and used as an external stroke adjuster. On occasions spacers are attached to the machine member connected to the piston rod and also used as a stroke adjuster. In both cases the stops will create a pinch point and the user should consider appropriate use of guards. If these external stops are not perpendicular to the mating contact surface, or if debris is trapped between the contact surfaces, a bending moment will be placed on the piston rod, which can lead to piston rod failure. An external stop will also negate the effect of cushioning and will subject the piston rod to impact loading. Those two (2) conditions can cause piston rod failure. Internal stroke adjusters are available with and without cushions. The use of external stroke adjusters should be reviewed with our engineering department.

The piston rod to piston and the stud to piston rod threaded connections are secured with an anaerobic adhesive. The strength of the adhesive decreases with increasing temperature. Cylinders which can be exposed to temperatures above +250°F (+121°C) are to be ordered with a non studded piston rod and a pinned piston to rod joint.

2.3 Cushions – Cushions should be considered for cylinder applications when the piston velocity is expected to be over 4 inches/second.

Cylinder cushions are normally designed to absorb the energy of a linear applied load. A rotating mass has considerably more energy than the same mass moving in a linear mode. Cushioning for a rotating mass application should be review by our engineering department.

2.4 Cylinder Mountings – Some cylinder mounting configurations may have certain limitations such as but not limited to minimum stroke for side or foot mounting cylinders or pressure de-ratings for certain mounts. Carefully review the catalog for these types of restrictions.

Always mount cylinders using the largest possible high tensile alloy steel socket head cap screws that can fit in the cylinder mounting holes and torque them to the manufacturer's recommendations for their size.

2.5 Port Fittings – Hydraulic cylinders applied with meter out or deceleration circuits are subject to intensified pressure at piston rod end.

The rod end pressure is approximately equal to:

$$\frac{\text{operating pressure x effective cap end area}}{\text{effective rod end piston area}}$$

Contact your connector supplier for the pressure rating of individual connectors.

3.0 Cylinder and Accessories Installation and Mounting

3.1 Installation

3.1.1 – Cleanliness is an important consideration, and cylinders are shipped with the ports plugged to protect them from contaminants entering the ports. These plugs should not be removed until the piping is to be installed. Before making the connection to the cylinder ports, piping should be thoroughly cleaned to remove all chips or burrs which might have resulted from threading or flaring operations.

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3.1.2 – Cylinders operating in an environment where air drying materials are present such as fast-drying chemicals, paint, or weld splatter, or other hazardous conditions such as excessive heat, should have shields installed to prevent damage to the piston rod and piston rod seals.

3.1.3 – Proper alignment of the cylinder piston rod and its mating component on the machine should be checked in both the extended and retracted positions. Improper alignment will result in excessive rod gland and/or cylinder bore wear. On fixed mounting cylinders attaching the piston rod while the rod is retracted will help in achieving proper alignment.

3.1.4 – Sometimes it may be necessary to rotate the piston rod in order to thread the piston rod into the machine member. This operation must always be done with zero pressure being applied to either side of the piston. Failure to follow this procedure may result in loosening the piston to rod-threaded connection. In some rare cases the turning of the piston rod may rotate a threaded piston rod gland and loosen it from the
cylinder head. Confirm that this condition is not occurring. If it does, re-tighten the piston rod gland firmly against the cylinder head.

For double rod cylinders it is also important that when attaching or detaching the piston rod from the machine member that the torque be applied to the piston rod end of the cylinder that is directly attaching to the machine member with the opposite end unrestrained. If the design of the machine is such that only the rod end of the cylinder opposite to where the rod attaches to the machine member can be rotated, consult the factory for further instructions.

3.2 Mounting Recommendations

3.2.1 – Always mount cylinders using the largest possible high tensile alloy steel socket head screws that can fit in the cylinder mounting holes and torque them to the manufacturer's recommendations for their size.

3.2.2 – Side-Mounted Cylinders – In addition to the mounting bolts, cylinders of this type should be equipped with thrust keys or dowel pins located so as to resist the major load.

3.2.3 – Tie Rod Mounting – Cylinders with tie rod mountings are recommended for applications where mounting space is limited. The standard tie rod extension is shown as BB in dimension tables. Longer or shorter extensions can be supplied. Nuts used for this mounting style should be torqued to the same value as the tie rods for that bore size.

3.2.4 – Flange Mount Cylinders – The controlled diameter of the rod gland extension on head end flange mount cylinders can be used as a pilot to locate the cylinders in relation to the machine. After alignment has been obtained, the flanges may be drilled for pins or dowels to prevent shifting.

3.2.5 – Trunnion Mountings – Cylinders require lubricated bearing blocks with minimum bearing clearances. Bearing blocks should be carefully aligned and rigidly mounted so the trunnions will not be subjected to bending moments. The rod end should also be pivoted with the pivot pin in line and parallel to axis of the trunnion pins.

3.2.6 – Clevis Mountings – Cylinders should be pivoted at both ends with centerline of pins parallel to each other. After cylinder is mounted, be sure to check to assure that the cylinder is free to swing through its working arc without interference from other machine parts.

4.0 Cylinder and Accessories Maintenance, Troubleshooting and Replacement

4.1 Storage – At times cylinders are delivered before a customer is ready to install them and must be stored for a period of time. When storage is required the following procedures are recommended.

4.1.1 – Store the cylinders in an indoor area which has a dry, clean and noncorrosive atmosphere. Take care to protect the cylinder from both internal corrosion and external damage.

4.1.2 – Whenever possible cylinders should be stored in a vertical position (piston rod up). This will minimize corrosion due to possible condensation which could occur inside the cylinder. This will also minimize seal damage.

4.1.3 – Port protector plugs should be left in the cylinder until the time of installation.

4.1.4 – If a cylinder is stored full of hydraulic fluid, expansion of the fluid due to temperature changes must be considered. Installing a check valve with free flow out of the cylinder is one method.

4.1.5 – When cylinders are mounted on equipment that is stored outside for extended periods, exposed unpainted surfaces, e.g. piston rod, must be coated with a rust-inhibiting compound to prevent corrosion.

4.2 Cylinder Trouble Shooting

4.2.1 – **External Leakage**

4.2.1.1 – Rod seal leakage can generally be traced to worn or damaged seals. Examine the piston rod for dents, gouges or score marks, and replace piston rod if surface is rough.

Rod seal leakage could also be traced to gland wear. If clearance is excessive, replace rod bushing and seal. Rod seal leakage can also be traced to seal deterioration. If seals are soft or gummy or brittle, check compatibility of seal material with lubricant used if air cylinder, or operating fluid if hydraulic cylinder. Replace with seal material, which is compatible with these fluids. If the seals are hard or have lost elasticity, it is usually due to exposure to temperatures in excess of 165°F. (+74°C). Shield the cylinder from the heat source to limit temperature to 350°F. (+177°C.) and replace with fluorocarbon seals.

4.2.1.2 – Cylinder body seal leak can generally be traced to loose tie rods. Torque the tie rods to manufacturer's recommendation for that bore size.

Excessive pressure can also result in cylinder body seal leak. Determine maximum pressure to rated limits. Replace seals and retorque tie rods as in paragraph above. Excessive pressure can also result in cylinder body seal leak. Determine if the pressure rating of the cylinder has been exceeded. If so, bring the operating pressure down to the rating of the cylinder and have the tie rods replaced.

Pinched or extruded cylinder body seal will also result in a leak. Replace cylinder body seal and retorque as in paragraph above.

Cylinder body seal leakage due to loss of radial squeeze which shows up in the form of flat spots or due to wear on the O.D. or I.D. – Either of these are symptoms of normal wear due to high cycle rate or length of service. Replace seals as per paragraph above.

4.2.2 – **Internal Leakage**

4.2.2.1 – Piston seal leak (by-pass) 1 to 3 cubic inches per minute leakage is considered normal for piston ring construction. Virtually no static leak with lipseal type seals on piston should be expected. Piston seal wear is a usual cause of piston seal leakage. Replace seals as required.

4.2.2.2 – With lipseal type piston seals excessive back pressure due to over-adjustment of speed control valves could be a direct cause of rapid seal wear. Contamination in a hydraulic system can result in a scored cylinder bore, resulting in rapid seal wear. In either case, replace piston seals as required.

4.2.2.3 – What appears to be piston seal leak, evidenced by the fact that the cylinder drifts, is not always traceable to the piston. To make sure, it is suggested that one side of the cylinder piston be pressurized and the fluid line at the opposite port be disconnected. Observe leakage. If none is evident, seek the cause of cylinder drift in other component parts in the circuit.

4.2.3 – **Cylinder Fails to Move the Load**

4.2.3.1 – Pneumatic or hydraulic pressure is too low. Check the pressure at the cylinder to make sure it is to circuit requirements.

4.2.3.2 – Piston Seal Leak – Operate the valve to cycle the cylinder and observe fluid flow at valve exhaust ports at end of cylinder stroke. Replace piston seals if flow is excessive.

4.2.3.3 – Cylinder is undersized for the load – Replace cylinder with one of a larger bore size.

4.3 Erratic or Chatter Operation

4.3.1 – Excessive friction at rod gland or piston bearing due to load misalignment – Correct cylinder-to-load alignment.

4.3.2 – Cylinder sized too close to load requirements – Reduce load or install larger cylinder.

4.3.3 – Erratic operation could be traced to the difference between static and kinetic friction. Install speed control valves to provide a back pressure to control the stroke.

4.4 Cylinder Modifications, Repairs, or Failed Component – Cylinders as shipped from the factory are not to be disassembled and or modified. If cylinders require modifications, these modifications must be done at company locations or by The Company's certified facilities. The Cylinder Division Engineering Department must be notified in the event of a mechanical fracture or permanent deformation of any cylinder component (excluding seals). This includes a broken piston rod, tie rod, mounting accessory or any other cylinder component. The notification should include all operation and application details. This information will be used to provide an engineered repair that will prevent recurrence of the failure.

It is allowed to disassemble cylinders for the purpose of replacing seals or seal assemblies. However, this work must be done by strictly following all the instructions provided with the seal kits.

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3. Delivery Dates; Title and Risk; Shipment. All delivery dates are approximate and Seller shall not be responsible for any damages resulting from any delay. Regardless of the manner of shipment, title to any products and risk of loss or damage shall pass to Buyer upon placement of the products with the shipment carrier at Seller's facility. Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferment of shipment at Buyers' request beyond the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omissions.

4. Warranty. Seller warrants that the Products sold hereunder shall be free from defects in material or workmanship for a period of twelve months from the date of delivery to Buyer or 2,000 hours of normal use, whichever occurs first. The prices charged for Seller's products are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **DISCLAIMER OF WARRANTY: THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED HEREUNDER. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING DESIGN, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

5. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon delivery. No claims for shortages will be allowed unless reported to the Seller within 10 days of delivery. No other claims against Seller will be allowed unless asserted in writing within 30 days after delivery. Buyer shall notify Seller of any alleged breach of warranty within 30 days after the date the defect is or should have been discovered by Buyer. Any action based upon breach of this agreement or upon any other claim arising out of this sale (other than an action by Seller for an amount due on any invoice) must be commenced within 12 months from the date of the breach without regard to the date breach is discovered.

6. LIMITATION OF LIABILITY. UPON NOTIFICATION, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE. **IN NO EVENT SHALL SELLER BE LIABLE TO BUYER FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT, EVEN IF SELLER HAS BEEN NEGLIGENT, WHETHER IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.**

7. User Responsibility. The user, through its own analysis and testing, is solely responsible for making the final selection of the system and Product and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application and follow applicable industry standards and Product information. If Seller provides Product or system options, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.

8. Loss to Buyer's Property. Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two consecutive years have elapsed without Buyer ordering the items manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Special Tooling. A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

10. Buyer's Obligation; Rights of Seller. To secure payment of all sums due or otherwise, Seller shall retain a security interest in the goods delivered and this agreement shall be deemed a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest.

11. Improper use and Indemnity. Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damages, lawsuits, and costs (including attorney fees), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, improper application or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Product; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

12. Cancellations and Changes. Orders shall not be subject to cancellation or change by Buyer for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change product features, specifications, designs and availability with notice to Buyer.

13. Limitation on Assignment. Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.

14. Force Majeure. Seller does not assume the risk and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter "Events of Force Majeure") Events of Force Majeure shall include without limitation: accidents, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller's reasonable control.

15. Waiver and Severability. Failure to enforce any provision of this agreement will not waive that provision nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

16. Termination. Seller may terminate this agreement for any reason and at any time by giving Buyer thirty (30) days written notice of termination. Seller may immediately terminate this agreement, in writing, if Buyer: (a) commits a breach of any provision of this agreement (b) appointments a trustee, receiver or custodian for all or any part of Buyer's property (c) files a petition for relief in bankruptcy on its own behalf, or by a third party (d) makes an assignment for the benefit of creditors, or (e) the dissolves or liquidates all or a majority of its assets.

17. Governing Law. This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement.

18. Indemnity for Infringement of Intellectual Property Rights. Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this Agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

19. Entire Agreement. This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged.

20. Compliance with Law, U. K. Bribery Act and U.S. Foreign Corrupt Practices Act. Buyer agrees to comply with all applicable laws and regulations, including both those of the United Kingdom and the United States of America, and of the country or countries of the Territory in which the Buyer may operate, including without limitation the U. K. Bribery Act, the U.S. Foreign Corrupt Practices Act ("FCPA") and the U.S. Anti-Kickback Act (the "Anti-Kickback Act"), and agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer, its employees or agents. Buyer acknowledges that they are familiar with the provisions of the U. K. Bribery Act, the FCPA and the Anti-Kickback Act, and certifies that Buyer will adhere to the requirements thereof. In particular, Buyer represents and agrees that Buyer shall not make any payment or give anything of value, directly or indirectly to any governmental official, any foreign political party or official thereof, any candidate for foreign political office, or any commercial entity or person, for the purpose of influencing such person to purchase products or otherwise benefit the business of Seller.

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